Chapter 5
Computational Telediagnosis and
Development of Clinical Telemedicine

5.1. Main Achievements of Computational Telediagnosis in the Middle of
the 20th Century

In the late 1970s, a new line of research was formed that can be called
conventionally as "computational telediagnosis". It was supposed to use the
remote transmission of certain medical information for its automated
analysis by a computer machine for the purpose of diagnosis, screening and
monitoring. This idea was successfully realized in the field of
telecardiology and partly in tele-EEG (as specifically described in the
relevant sections), but there were some achievements in other disciplines as
well.

In the USSR, a number of research teams developed computer systems
with data entry over telephone communication channels, and feedback
(formalized conclusion) sent by teletype. Such tools of "computing
telediagnosis" were developed by Yu. I. Barashnev, I. M. Beskrovnyy, M.
P. Vilyanskyy, R. I. Dubov, B. D. Zhigarev, M. V. Zhilinskaya, N. I.
Moiseeva, N. V. Fentsov and others in the fields of clinical genetics,
traumatology, emergency, surgery, paediatrics, neurosurgery and laboratory
diagnostics (Barashnev Yu., et al. 1979; Beskrovnyy I. et al., 1979;
Vilyanskyy M. et al., 1979; Dubov R. et al., 1979; Zhigarev B., 1979;
Zhigarev B. et al., 1979; Moiseeva N. et al., 1979; Fentsov N.et al., 1979)
(Fig. 5.1-5.2).

![Fig. 5.1 Ivan M. Beskrovnyy](image1)

![Fig. 5.2 Yuri I. Barashnev](image2)
The extent of implementation varied from conceptual ideas to entirely working systems with fully proven efficiency. The most striking practical implementation of the "computing telediagnosis" concept was recorded in Yaroslavl. In 1979, the team of Yaroslavl Medical Institute, consisting of Mark P. Vilyanskyy, Aleksandr A. Chumakov and Aleksandr N. Khorev, developed the remote acute abdomen diagnosis system based on the automated analysis of data transmitted from remote hospitals (Fig. 5.3-5.5). The system was approved successfully by treating of 470 patients. An around-the-clock "consultative remote diagnosis centre" was established at the Institute clinic (Vilyanskyy M. et al., 1979). The "Nairi-K" computer was used applying software for recognition of acute abdomen diagnosis in patients with unclear clinical picture. The system was operated by nurses.

The above mentioned system supported a telemedicine network that included municipal and rural hospitals connected by telephone lines. The number of successful teleconsultations increased to 874, including 122 consultations on patients admitted in the rural hospitals. The diagnostics accuracy was about 89%. The system was found to be effective and promising. It was planned to equip the network additionally with teletypes and implement similar networks in the remote areas (including along the route of the Baikal-Amur Mainline construction) (ibid).

In the early 1980s, a Medical Automated System Centre was established at Altai Territorial Medical Information Computer Centre (Barnaul, USSR/Russia). "Computer diagnostics" were used in cardiology and surgery too (Fig. 5.6-5.7) (Emeshin K., 2012).
Electrocardiosignals were received from the territorial tele-ECG network (described in the appropriate chapter), and remote diagnostics of surgical pathology were conducted on the basis of special algorithms. At least 9,500 computing teleconsultations were provided for patients with surgical pathology. The work was headed by Dr. Nikolai F. Gerasimenko (Fig. 5.8) (ibid).

In the USSR, between 1978-1982 and 1983-1990 the targeted comprehensive program "Development and introduction of automated systems for consultative diagnosis, prognosis and treatment policy selection in case of medical emergencies" was implemented. The program applied the main achievements in the field of clinical telemedicine at that time. Professor Suren A. Gasparyan (2002) (Fig. 5.9) describes this as follows: "By the end of the 1970s, computer equipment and developments of mathematical methods for medical diagnosis and prognosis have created the conditions
for implementation of practical diagnostic systems, accumulating the experience of clinical medicine. Technical facilities allowed conferring a remote character for such systems in order to enable medical institutions to address remote diagnostic centres for consultation”.

Program researchers determined the development of construction principles, the structure of medical information, mathematical, technical and organizational support of such systems. They performed research trying to create a standard system on the basis of domestic computer equipment, which at that time was especially important. They carried out the construction and implementation of standard automated systems for diagnosis, prognosis and treatment policy selection in case of emergency for local health services. At the same time the scientists solved a wide range of clinical, organizational, social and economic problems. The description of the program and system is quoted as it stands in Gasparyan (2002) and Pashkina and Zarubina (2010): "The program brought together 12 research institutes, 3 universities and 3 computer and information centres. It was monitored by V. S. Saveliev, the USSR Academy of Medical Sciences, Academician, Professor, and L. G. Erokhina, head of the section, a member of the coordinating council, Professor. The leading institution was the Republican Information Computer Centre of the RSFSR Ministry of Health (S. A. Gasparyan, Professor, Research Program Manager, Chairman of the Coordination Council; M. L. Bykhovsky, Professor, deputy chairman of the Coordination Council, scientific consultant). The main institution for project documentation development was the Information Computer Centre of Primorsky Territorial Public Health Department (A. A. Rybchenko, PhD., deputy chairman of the Coordination Council, head of the section; A. A. Savchuk, academic secretary of the program section).

The main institutions participating in the program were:

- The Saratov branch of the Leningrad Scientific Research Institute of Cardiology (team leaders: E. Sh. Halfen, Honoured Worker of Science of the Russian Federation, Professor, deputy chairman of the Coordination Council, head of the section; and V. N. Shemetenko, academic secretary of the program section);
- Yaroslavl Medical Institute (team leaders: M. P. Vilyanskyy, Professor, head of the section, a member of the Coordination Council

Fig. 5.9 Suren A. Gasparyan
Council; A. A. Chumakov, Ph.D., Associate Professor and A. N. Khorev, academic secretary of the program section);

- Russian National Research Medical University (RNRMU) named after N. I. Pirogov (team leaders: S. M. Prigozhina, Ph.D., senior staff scientist, academic secretary of the program section, a member of the Coordination Council; V. A. Boyadzhyan, Doctor of Medical Science; E. S. Pashkina, academic secretary of the program section);

- Leningrad Scientific Research Institute of Neurosurgery named after A. L. Polenov (team leaders: Yu. V. Zotov, Professor, head of the section, a member of the Coordination Council; B. G. Budashevskyy, Ph.D., senior staff scientist, and A. F. Lepekhin, Ph.D., academic secretaries of the program section);

- Leningrad Paediatric Medical Institute (team leaders: I. M. Vorontsov, Professor, head of the section, a member of the Coordination Council; E. V. Gubler, Professor, academic secretary of the program section, a member of the Coordination Council);

- Moscow Scientific Research Institute of Paediatrics and Paediatric Surgery (team leaders: Yu. E Veltishchev, Honoured Worker of Science of the Russian Federation, Corresponding Member of the USSR AMS, Professor, head of the section, a member of the Coordination Council; and B. A. Kobrinskyy, Ph.D., academic secretary of the program section, a member of the Coordination Council).

Participating institutions included also:

- MONIKI named after M. F. Vladimirskyy (team leaders: T. S. Vinogradova, Professor, a member of the Coordination Council; M. P. Pachin, Ph.D., a member of the Coordination Council);

- Altai Territorial Medical Information Computer Centre (team leader: K. N. Emeshin, Ph.D., Associate Professor, a member of the Coordination Council);

- Information Computer Centre of Sverdlovsk Regional Public Health Department (team leader: V. L. Gurevich, Ph.D., academic secretary of the program section, a member of the Coordination Council);
• Gorky Medical Institute (V. D. Troshin, Professor, a member of the Coordination Council; E. P. Troshin, Professor, a member of the Coordination Council; E. P. Strongin, principal investigator);
• Gorky Scientific and Research Institute of Traumatology and Orthopaedics (the team consist of L. B. Likhterman, Professor, head of the section, a member of the Coordination Council; Yu. I. Neimark, Professor, academic secretary of the program section; V. M. Troshin, Ph.D., senior staff scientist, principal investigator);
• Information Computer Centre of Directorate General for Health Services of Leningrad Municipal Executive Council (E. R. Useinov, a member of the Coordination Council; M. M. Zimnev, academic secretary of the program section),
• Leningrad Municipal Hostital No.3 (team leader G. A. Khay, PhD, head of the section; a member of the Coordination Council);
• Sverdlovsk Medical Institute (team including E. N. Krupin, Professor and M. Ya. Charnis, principal investigator).

In addition, the members of the Coordination Council of the national targeted comprehensive program were V. A. Alekseev, Ph.D., Associate Professor, Deputy Head of Directorate General for healthcare assistance to children and mothers of the RSFSR Ministry of Health and S. M. Kulagin, Ph.D., Head of Directorate General for healthcare assistance to children and mothers of the RSFSR Ministry of Health. The Information Computer Centre of Primorsky Territorial Public Health Department became the design centre of a standard replicated system of remote computing emergency diagnostics based on the algorithms and programs developed in research institutes and high schools. It director was A. A. Rybchenko, Ph.D.

The system of remote computing emergency diagnostics functioned on the basis of formalized cards. Consultative diagnostic centres were established at the medical aviation service stations of regional, territorial and national hospitals. Their work was carried out continuously 24 hours a day. A user dictated the numbers of diagnostic signs, specified in the clinical standardized card, over a direct telephone line. The numbers were uploaded to the computer by an attending physician. Within 20-30 seconds, a possible diagnosis was issued. Sometimes clinical or laboratory data were offered that had to be added for more precise differential diagnoses".

The amount of the accumulated data and study of the effectiveness conducted by S. A. Gasparyan is impressive (Gasparyan S., 2002; Pashkina E., Zarubina T., 2010): "Analysis of the results of 39 000 consultations in the course of two-year work of three consultative centres showed that the overall quality of diagnosis by doctors in rural and district hospitals is 63%. When addressing the computing consultative diagnosis centre for
consultation, accuracy rises up to 86%. Repeated consultation, including additional data for computer accuracy, increased the diagnostic accuracy up to 96%. Thus, the early diagnosis quality for critical health conditions was enhanced at the prehospital stage and in the in-hospital departments without an increase of resources for emergency assistance. This reduced mortality in children's hospitals of Leningrad by more than 15% during the period between 1976-77 to 1981-82 and to some extent infant mortality in general. The accuracy of statistical information on critical health conditions and their outcomes increased as well, and it was possible to obtain data on the defects in the health services operation that caused the increase of critical conditions. The developed system of remote computing emergency diagnostics was implemented in more than 40 territories of the Russian Federation. It was also used by the Far East fishing fleet. The system solved a critical economic problem by improving the quality of diagnosis in case of emergency conditions in the countryside, in remote areas and on ships at sea".

In the USA in 1965, Professor Lawrence W. Stark and Dr. James F. Dickson described computing telemedicine system for scientific research in the field of neurology in Massachusetts (USA). Physiological information was transmitted from four laboratories located in three medical institutions (National Institutes of Health, the Memorial and General hospitals) over telephone lines and teletype to the computer centre at the Massachusetts Institute of Technology for automated analysis. A series of studies was carried out with this telemedicine system in the field of physiology of the vision organ and the nervous regulation (Fig. 5.10-5.11) (Stark L., Dickson J., 1965).

Also in 1965, a computerized laboratory telediagnosis system was installed in the Missouri Medical Centre (USA) headed by Dr. Donald A. B. Lindberg (for more details refer to the chapter on telecardiology). This was a kind of "superstructure" over the prototype of the medical information system which was already in use since 1955 (Fig. 5.12). At the time of publication “Automated laboratory data handling” (1965), the system had accumulated a significant number of radiological images and more than 60000 ECGs with explanations and interpretations. It was assumed that the laboratory telediagnosis would be used in half a million examinations per year (ibid).
In the early and mid 1960s, many hospitals in the USA were equipped with teletypes for external document workflow, exchange of information about the movement of patients and statistical data. In particular, in 1961, this equipment was installed in Philadelphia at the Blue Cross organization (Teletypes installed at hospitals, 1961).

In 1964, the common teletype network covered 102 Veteran Hospitals in 21 states (40 new stations join local VA hospital hookup, 1964). This equipment was also used successfully in the computerized diagnosis complexes (Fig. 5.13) (40 new stations join local VA hospital hookup,
1964; Teletypes installed at hospitals, 1961). Chapter "Telecardiology" provides additional details on the development of computing Telecardiology.

5.2. Clinical Telemedicine Formation

In the 1970s, a wide range of clinical telemedicine projects was implemented in the United States based on video communication and on biotelemetry. For example, in Puerto Rico in 1974, a telemedicine network was established, consisting of three bilateral microwave channels for video, audio and telemetry information exchange between Guayama and Ponce at a distance of about 70 km. The network was implemented by local specialists Dr Victor Carlo of the Ponce District Hospital and electrical engineer Luis Rivas Calderon.

It was remarkable that they used tele-auscultation. As Dr. Carlo stated: "The system has worked so well in preliminary tests that the sounds picked up by the stethoscope come out as clear as if you had the patient right next to you". The telemedicine network demonstrated efficient approach of qualified medical assistance to the place of necessity and logistics optimization (Puerto Rico takes to “telemedicine”, 1974). Most of the above mentioned projects had rather local value, so we shall give only summarized information (Table 5.1) (Bennett M., 1978).

Table 5.1 Clinical telemedicine projects in the USA during 1969-1979

<table>
<thead>
<tr>
<th>State</th>
<th>Applied</th>
<th>Activity</th>
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<tbody>
<tr>
<td>Alabama</td>
<td>1969-1979</td>
<td>Computerization of work of nurses and general practitioners' offices, transtelephonic telemetry, telephone teaching conferences for nurses</td>
</tr>
<tr>
<td>Appalachian Mountains</td>
<td>1974-1975</td>
<td>Clinical medicine and distant learning by means of satellite audio communication (ATS-6), network of 10 VA hospitals</td>
</tr>
<tr>
<td>California</td>
<td>1977-1978</td>
<td>Telemedicine network between rural localities (without hospitals) and general practitioners' offices; communications by telephone and one-side slow-scan video</td>
</tr>
<tr>
<td>Colorado</td>
<td>1976-1979</td>
<td>Telemedicine network for rural area based on computerized telediagnosis</td>
</tr>
<tr>
<td>State</td>
<td>Years</td>
<td>Description</td>
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</tr>
<tr>
<td>Connecticut</td>
<td>1971-1978</td>
<td>Telemedicine and distant learning by means of VCC*; a network between the University clinic and 2 hospitals</td>
</tr>
<tr>
<td>Hawaii and Pacific Islands</td>
<td>1971-1978</td>
<td>Clinical medicine and distant learning by means of satellite audio and facsimile communication (ATS-1)</td>
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<tr>
<td>Indiana</td>
<td>1967-1978</td>
<td>Distant learning by means of audio and video conference communication; a network of 7 University centres and over 40 hospitals</td>
</tr>
<tr>
<td>Maine</td>
<td>1971-1978</td>
<td>Networks based on VCC between 3 private hospitals, a Memorial hospital and nursing ambulance station</td>
</tr>
<tr>
<td>Minnesota</td>
<td>1972-1974</td>
<td>Clinical telemedicine by means of VCC with medical data transmission (ECG, X-ray patterns, laboratory analyses results); a network between 2 hospitals</td>
</tr>
<tr>
<td>Nebraska</td>
<td>1976-1979</td>
<td>Telemedicine for the primary level of health care on the basis of facsimile, radio and telephone communication</td>
</tr>
<tr>
<td>New Mexico</td>
<td>1973-1979</td>
<td>A network between 7 isolated hospitals in the low inhabited area on the basis of radio and telephone communication (teleconsultations, briefing, distant learning). Telemedicine based on VCC for industrial and mining settlements</td>
</tr>
<tr>
<td>Ohio</td>
<td>1974-1979</td>
<td>Clinical telemedicine and distant learning by means of VCC between the University clinics and 6 hospitals</td>
</tr>
<tr>
<td>Oregon</td>
<td>1976-1979</td>
<td>Telemedicine for the primary level of health care on the basis of slow-scan video</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>1976-1979</td>
<td>Telemedicine for the primary level of health care on the basis of slow-scan video and medical data transmission (ECG, X-ray patterns, laboratory analyses results)</td>
</tr>
</tbody>
</table>
Texas | 1974-1979 | Telemedicine (teleconsultations, management, distant learning) for the primary level of health care based on VCC

*VCC - video conference communication*

An important feature in this period was the evident emphasis on the educational opportunities for health care offered by telecommunications.

Starting from the 1970s, an important development of clinical telemedicine, i.e. its integration into the routine health care, was made in Canada. This process was based on two projects.

Between October 1976 and February 1977, the Hermes communications satellite was used for telemedicine purposes in London, Ontario, Canada. The telemedicine project was managed by Dr. Lewis Stafford de Sausmarez Carey, Chairman of diagnostic radiology and nuclear medicine at the University of Western Ontario. Communication between the University clinic and the remote hospital, rendering first aid, was established. Telemedicine tools included: satellite communication line, a one-way video and data transmission, two-way exchange of audio information and facsimile communication (Fig. 5.14) (Carey L. et al., 1979).

A video camera mounted in the hospital was controlled remotely by consultants in the clinic; interactivity was provided by facsimile and voice communication. The teleconsultations were held mainly for nurses, and general practitioners received advisory support on radiology, anaesthesiology, cardiology, pathology, haematology, physiotherapy, dentistry, pharmacy, infection control, respiratory therapy, administration (ibid).

During the period between September 1977 and December 1979, the telemedicine network was organized between 20 health care units, 7 nursing ambulance stations, a hospital in the town of Sioux Lookout and 2 consultative centres in Toronto. The network was managed by Earl V. Dunn (Family Medicine Chair, University of Toronto) and David W. Conrath (Department of Science, University of Waterloo) (Fig. 5.15-5.16) (Dunn E. et al., 1977). Radio, telephone (cable and wireless) and satellite channels were used as communication lines. Slow-scan video communication was the major telemedicine tool. The video information was transmitted via the cable telephone lines.

![Fig. 5.14 Lewis Stafford de Sausmarez Carey](image-url)
The project compared the quality of primary health care with and without the use of telemedicine. The economic effects were also evaluated. The project demonstrated the technical availability and reliability of the telemedicine decisions, as well as the economic efficiency by optimizing the logistics (ibid). In 1977, Earl Dunn, David Conrath, William G. Bloor and Barbara Tranquada published an article reporting the experience of telemedicine consultations on more than 1,000 patients. A thorough comparison of the diagnostic accuracy and clinical value of various telemedicine tools (two-way black-and-white and color video conferencing, hands-free phones, slow-scan video communication) was also provided. Teleconsultations were held between the hospital in Flemington and the University Hospital in Sunnybrook. The authors pointed out that there were no major differences in the diagnostic value between various telemedicine tools. Also they studied diagnostic and treatment programs offered by doctors-subscribers and consultants, in terms of their complexity, duration, safety. The authors compared the logistics solutions, too. They found insignificant statistical difference between the telemedicine tools, which is quite strange considering the comparison of different technologies such as telephony and video communication. The results surprised the researchers and they recommended to make decisions based on clinical issues and economic feasibility (ibid).

In 1976, at the Memorial University of Newfoundland (Canada) a telemedicine project was implemented. The project was dedicated to clinical teleconsultation and distant learning. It was carried out under the supervision of Dr. Arthur Maxwell House (Fig. 5.17), with the participation of W. C. McNamara, Judy M. Roberts and others. By 1977, a full-fledged telemedicine centre was established. Four remote hospitals, in Stephenville, Goose Bay, St. Anthony and in Labrador City, interacted with the University via satellite communications and video conferencing (Distance Education and Learning Technologies, 2015; M.U.N.’s Telemedicine
Experiment, 2015; Roberts J. et al., 1993; Tele-Health and Tele-Education at Memorial University of Newfoundland 1977-1981, 2015; The Faculty of Medicine Founders’ Archive, Memorial University of Newfoundland, 2015; The early days of the medical school at Memorial University of Newfoundland. Administrative History: Telemedicine, 2015).

Initially, only one-way audio and video transmission via Hermes satellite was carried out. The telephony was used for interactive communication. These technologies allowed implementing distant learning. A few months later, slow-scan television communication and biotelemetry, with data transmission over cable channels, was tested. In general, this demonstrated the importance and effectiveness of health care telecommunications and enabled to continue the program.

With the use of the Anik B satellite, telemedicine collaboration was established between the University and the oil platforms. The operating methods were adjusted and special terminals were developed. Based on the latter, the University telemedicine network was established between 170 institutions in 80 different locations. In addition to the active distant learning telemedicine, consultations were also constantly held such as (Fig. 5.18-5.26, source http://telehealth.gcatt.gatech.edu) (ibid):

- Teleradiology (X-ray patterns, sonograms, simultaneous fluoroscopy) by means of slow-scan television communication to at least 3 hospitals;
- Neurological and cardiac teleconsultations by means of biotelemetry to at least 6 hospitals. About 1 200 tele-EEG consultations annually; urgent tele-ECG service for most hospitals were organized;
- Clinical video conferences with the demonstration of the disease place, micropreparations, interactive discussion of patients, as well as - for telepsychiatry.

Later teletype communications and e-mail were also used. Monthly a significant amount of clinical sessions was held. For example, in 1977, 216 teleconsultations were organized between the University Centre and the Hospital in Moose Factory. This telemedicine program was headed by Dr. Lewis Stafford de Sausmarez Carey.

During 15 years of active service the network grew significantly. By the early 1990s it covered 190 teleconferencing points at 100 institutions, including rural hospitals, district administration, university campuses, rural
schools (50), and nursing ambulance stations in the provinces of Newfoundland and Labrador. Up to 5,500 hours of distant learning were provided annually. Numerous telemedicine consultations were given with the use of teleradiology, video conferencing (slow-scan television communication) and biotelemetry facilities.

Fig. 5.18. Tele-EEG (Newfoundland, Canada, 1977-1982)

Fig. 5.19. Teletype transmission of medical data (Newfoundland, Canada, 1977-1982)

Fig. 5.20. Distant learning in the health care (Newfoundland, Canada, 1977-1982)
Fig. 5.21. Video conferences in teleradiology (Newfoundland, Canada, 1977-1982)

Fig. 5.22. Video conferences (slow-scan television communication) for teleradiology purposes (telebridge between Canada and Austria - presentation of Dr. A. M. House at the Unispace’82 conference)
In 1982, the technological base of the telemedicine center at the Memorial University of Newfoundland was used to create a national telemedicine network that covered 16 medical educational institutions.

In 1988, the University telemedicine center was transformed into the Telemedicine and Educational Technology Resources Agency (TETRA). On basis of the experience gained, the Memorial University of Newfoundland implemented a number of educational projects for the islands of the Atlantic and Pacific oceans, as well as for African countries. Satellite links and more seldom radio communication were mainly used (ibid).
In 1987, at the research center of telecommunications administration in Tromsø (Norway), a Department of telemedicine was organized, which in future became the Norwegian Centre for Telemedicine, one of the world's leading specialized scientific and clinical organizations (Fig. 5.27) (20 years of telemedicine in Tromsø: a historical retrospective, 2015).

5.3. Formation of Separate Lines of Clinical Telemedicine

Specialities of clinical telemedicine that were developed before the 1990s were teleradiology and telepathology.

5.3.1. Teleradiology

Since 1957, at the University of Montreal (Canada), Professor Albert Jutras began supervising the development of teleradiology for the diagnosis of the respiratory system diseases, gastrointestinal tract and oncological gastric pathology. A. Jutras introduced such terms as "remote radiodiagnosis", "video-tele-radiodiagnosis", "teleroentgen diagnosis", "telefluoroscopy" (Jutras A., 1957; 1959 a), b); 1960; Jutras A., Duckett G., 1957). Under the supervision of A. Jutras and the participation of Dr. Guy Duckett, a cable (coaxial) telemedicine system, connecting two hospitals in Montreal, Hotel Dieu and St. Jean Talon, separated by 10 km, was established. Successful fluoroscopic imaging exchange was implemented in order to improve diagnostic decision. Yet, the concept of A. Jutras found only "intra-hospital" applications. In most cases, radiological images were not transmitted between health care facilities, but within them. Nevertheless, higher safety and quality of radiologic examinations were achieved (Fig. 5.28-5.30) (ibid).
In the USA in 1947, G. Austin developed a system for X-ray imaging transmission via telephone cable and radio (Bashshur R. et al., 2014). In the same year, a team of radiologists and engineers headed by Professor Jacob Gershon-Cohen and with the participation of A. G. Cooley established a system for radiological imaging transmission by facsimile communication, called "telognosis", between the cities of Philadelphia and Westchester. The transmission of one image took up to 5 minutes (Fig. 5.31) (Gershon-Cohen J., 1951; Gershon-Cohen J. et al., 1957; Gershon-Cohen J., Cooley A., 1949, 1950, 1956).

According to the official definition, telognosis was an interpretation of facsimile roentgenograms received remotely with the help of telephone or radio communication (New developments in cancer, 1952). Gershon-Cohen introduced also the term "videognosis" to provide roentgenogram teleconsultation via television link (Gershon-Cohen J., 1951; Gershon-Cohen J. et al., 1957; Gershon-Cohen J., Cooley A.,
1949, 1950, 1956). In 1951, he considered remote diagnostics of X-ray imaging the most essential tool for improving health care quality in rural hospitals (ibid). "Videognosis" technology was performed between Philadelphia and New York. In the mid-1950s, together with Dr. Harry Shay, Professor Gershon-Cohen transmitted full-color radiological images.

Professor Jacob Gershon-Cohen, recognized as the creator of the concept of telo- and videognosis, is one of the founders of mammography and thermography, too. This energetic man and talented scientist devoted all his life to radiology. Few weeks before his death he demonstrated the possibilities of roentgenogram teleconsultation using one of the world's first videotelephones (Bell Picturephone®).
In the 1970s, teleradiology systems, using television communication, were used in USA, France, Japan and Sweden (Fig. 5.32-5.33). In parallel with the television communication, systems for transtelephonic data transmission - facsimile and teletype, were used particularly in France. The subscriber reported the patient's parameters by phone, computer mapping and dose calculation were performed in the expert centre, and the results were "returned" by facsimile.

In 1972, doctors W. S. Andrus and T. K. Bird introduced the term "teleradiology" (Andrus W., Bird T., 1972). Their activities in this field were described in details in the chapter devoted to video conferencing).

In the late 1970s, a teleradiological network was organized in Canada, using the *Hermes* satellite. Diagnostic imaging exchange was established between the nursing ambulance stations, district hospitals and university medical centres. The project was headed by doctors Lewis S. Carey and Earl Stuart Russell. According to the project authors, teleradiography and telefluoroscopy consultations were effective in 90% of cases (Fig. 5.34-5.35) (Carey L. et al., 1979; TV X-Rays in Hull Hospital, 1961; Gitlin J., 1986; Thomas A., 2015).

Fig. 5.34. Earl Stuart Russell

Fig. 5.35. Teleradiology: a radiologist works remotely at the expert centre, roentgenogram digitalization by video camera (USA, 1986)

In 1973-1975 a teleradiological network, based on wireless slow-scan television communication, was operating in Omaha (Nebraska, USA). The system interactivity was provided by two-way voice communication. Teleconsultations were carried out between a rural hospital in Broken Bow and the University clinic. In 1976 a teleradiological network was started up in St. Louis (Missouri, USA) between the VA Medical Centre and several rural hospitals.
One of the project supervisors was Dr. Robert Donati. At the end of each working day the technical staff transmitted the results of all conducted examinations to the expert centre for computer processing (by Bell Dataphone). Interpretations and conclusions were sent by teletype during the next day (Bennett M., 1978).

5.3.2. Telepathology

It is remarkable that the first experiments on the transmission of cytological images dated back to the 1950s-1970s (Fig. 5.36, http://www.earlytelevision.org/skf_color.html; National Museum of Health and Medicine, AFIP, SC 521401 - http://www.smecc.org/walter_reed_rca_color_television.htm). Powerful digital tools of telepathology are used in modern health care, but for the described period (up to the 1990s) special attention should be paid to the following facts:

Fig. 5.36. Telepathology by means of television communication. Lt. colonel H. Sprinz, Surgical Pathologist operates the completely new color TV microscope), Walter Read Hospital (USA, 14 November 1957), a photo of Steve Dichter

In 1986, the first robotic telemicroscopic system was created and successfully implemented in the United States, which marked the start of an entirely new generation of telepathology instruments (Fig. 5.37) (Park S. et al., 2013).

Also in 1986, Professor Ronald S. Weinstein introduced the term "telepathology" (Fig. 5.38) (Weinstein R., 1986; Weinstein R. et al., 1987). Telepathology, according to Weinstein, is the practice of pathology at a distance by visualizing an indirect image on a video monitor screen rather than viewing a specimen directly through a microscope (ibid).
So, the dominant line of telemedicine in the 20th century was undoubtedly computing telediagnosis, based on computer analysis of formalized medical information. Despite the rapid growth and development of various programs and systems, currently this tool is practically not used anymore.

On the other hand, the 1970s-1980s were marked by the formation of clinical telemedicine models and principles, which became the basis of modern e-Health.

References


[8] Beskrovnyy I. M., Zabashta P. T., Okhotskyy V. P., Revin F. I. [Remote probabilistic estimation of the expected severity of the trauma in patient on the basis of symptoms that characterize the circumstances of the injury], Vycheslitelnaya diagnostika i telemetricheskaya obrabotka meditsinskoy informatsii, Tezisy II Vseros. nauch.-pract. conf. po med. Kibernetike, Gorky, 1979, pp. 16-17 (in Russian), Бескровный И. М., Забашта П. Т., Охотский В. П., Ревин Ф. И. Дистанционная вероятностная оценка ожидаемой тяжести состояния травматологического больного на основе признаков, характеризующих обстоятельства травмы, Вычислительная диагностика и телеметрическая обработка медицинской информации, Тезисы II Всерос.науч.-практ.конф. по мед.кибернетике, Горький, 1979, с. 16-17


[10] Distance Education and Learning Technologies (DELT), Memorial University of Newfoundland, http://www.delts.mun.ca


информации для клинико-биохимического отдела НИИ СП им. Склифосовского, Вычислительная диагностика и телеметрическая обработка медицинской информации. Тезисы II Всерос.науч.-практ.конф. по мед.кибернетике, Горький, 1979, с. 158-159


[22] Jutras A. Gastric cancer at its initial stage and teleroentgen diagnosis. Union Med Can., 1960 Nov 15, 89, pp. 1413-1426


[27] Moiseeva N. I., Sergeev V. A., Sheremetieva L. V. [Medical information in the computer system for remote diagnostics], Vycheslitelnaya diagnostika i telemetricheskaya obrabotka meditsinskoy informatsii, Tezisy II Vseros. nauch.-prakt. conf. po med. Kibernetike, Gorky, 1979, pp. 50-51 (in Russian), Моисеева Н.И., Сергеев В.А., Шереметьева Л.В. Медицинские сведения в системе вычислительной дистанционной диагностики, Вычислительная диагно-стика и телеметрическая обработка медицинской информации, Тезисы II Все-рос.науч.-практ.конф. по мед.кибернетике, Горький, 1979, с. 50-51


[31] Puerto Rico takes to “telemedicine”, Las Cruces Sun-News, Las Cruces, New Mexico, Thu, May 30, 1974, p. 21


[34] Stark L., Dickson J. F. Remote computerized medical diagnostic systems. Computers and automation, July 1965, pp. 18-21


[37] The early days of the medical school at Memorial University of Newfoundland. Administrative History: Telemedicine, http://www.med.mun.ca/earlydays/pages/05education/07telemedicine/telemedicine.html

[38] The Faculty of Medicine Founders' Archive, Memorial University of Newfoundland, http://www.med.mun.ca/earlydays/pages/copyright.html

[39] Thomas A. Teleradiology flourishes from humble beginnings, ttp://www.auntminnieeurope.com

[40] TV X-Rays In Hull Hospital, The Ottawa Journal, Ottawa, Ontario, Canada, Wed, Mar 1, 1961, p. 21


[45] Zhilinskaya M. V., Gracheva G. S. [Trends in the development of children's health as a basis for selecting the direction of remote diagnostics in pediatrics], Vycheslitelnaya diagnostika i telemetricheskaya obrabotka meditsinskoy informatsii, Tezisy II Vseros. nauch.-pract. conf. po med. Kibernetike, Gorky, 1979, pp. 31-32 (in Russian), Жилинская М. В., Грачева Г. С. Тенденции в развитии детского здравоохранения как основа для выбора направления дистанционной диагностики в педиатрии /Вычислительная диагностика и телеметрическая обработка медицинских ин-формации, Тезисы II Всерос.науч.-практ.конф. по мед.кибернетике, Горький, 1979, с. 31-32
Chapter 6
Telemedicine Satellite Technologies

6.1. Transatlantic Telemedicine

On May 26 and July 3 1958, Dr Arthur Briskier (New York, USA) performed experiments on medical information transmission via shortwave radio and telephoto transmitter. As early as 1953, Briskier developed the system of electromagnetic cardiac auscultation recording. On those dates, a volunteer’s heart tones were recorded by using his equipment in New York (USA). Then the record was transmitted to Paris (France) via radio and translated back by the author himself to test the diagnostic quality of the record (Fig. 6.1) (Briskier A., 1958, 1959).

![Fig. 6.1. Dr A. Brisker (in a black jacket) testing his telemedicine system (New York, USA, 1958)](image)

Thereafter, some anthropological and clinical data as temperature, blood pressure, ECG, thoracic cage X-ray, lab results, etc. were sequentially translated by applying "radiophotos" (Fig. 6.2) (ibid). Experiments continued with records from several volunteers:

- A healthy volunteer;
- Patients suffering from mitral or aortic stenosis or incompetence;
- Pre- and post-operation data of patients who had undergone heart surgery for bacterial endocarditis and heart disease;
- Cardiac auscultation records of a pregnant woman and a fetus immediately prior to the delivery.
Arthur Briskier established the high diagnostic value of the method. He underlined that the system was overcoming the language barrier, as the data did not “contain words”, but only visual and graphic images. The conclusions highlighted the universality and importance of such technologies for urgent situations, transport medicine, and also for caustic cases (ibid).

In the 1960s, NASA placed the first telecommunication satellites into geostationary orbit, enabling super-fast data transmission, including biomedical ones, between Europe and America. In 1963, one of the first transatlantic biotelemetry projects was implemented (Larks S., 1964; Marquette Scientist, 1962; Ray C. et al. 1965). The participants included (Fig. 6.3-6.7):

- **In USA:**
  - The Mayo Clinic staff in Rochester, Minnesota. (Doctors Reginald G. Bickford, Wayne Russert, Christie Ray, Don Carroll);
  - The NASA representatives (Leonard Jaffee, Joseph M. Gerrety), the Federal Commission for Communication (E. William), telephone companies (John Brunnette, Dill Burke);
  - Experts from the medical electronic sphere of Magnavox company (William K. Hagan, George Nichter);
  - Mount Sinai hospitals staff (Milwaukee, Wisconsin,) and Parkview (Fort Wayne, Indiana);

- **In France:**

Fig. 6.2. Medical data transmitted by A. Briskier from North America to Europe via shortwave radio and radiophoto: the original to the left, the information received – to the right (1958)
• Professor Antoine Remond and his neurophysiological laboratory staff L.E.N.A, Salpetriere Hospital (Paris), and Dr Charles Dean Ray (USA);
• Dr Claude Suru, University of Paris;
• **In Great Britain:**
  • Neurological Institute of Barden staff in Bristol, Great Britain (Doctor William Grey Walter, Doctor Ray Cooper, W. J. Warren);
• **In Belgium:**
  • Dr Saul D. Larks (Marquette University, USA).
The transatlantic transmission project was implemented in several phases. First local preliminary tests of biotelemetry system at Mayo clinic were carried out with data exchange through Rochester-Minneapolis-Omaha cable telephone lines and backwards (Fig. 6.8) (Hagan W., Larks S., 1963; Ray C. et al., 1965). Engineering improvement of the system was performed, noise immunity was reinforced, and the artefacts were eliminated. The possibility of multichannel data transmission was provided. Telemetry rheoencephalography data approach was worked out, too (Fig. 6.9) (Ray C. et al., 1965).

The first transatlantic biotelemetric experiment took place on April 25, 1963 at 22.45 (GMT). A normal encephalogram was transmitted via satellite from the Neurologistic Barden Institute (Bristol, Great Britain). First the signal was directed through the cable channel from Bristol to Goonhilly Downs, then transmitted to the satellite, translated to North America, Nutley (New Jersey) and again sent to Rochester through cable with Bell dataphone. The encephalogram was successfully recorded in ECM and instantly transmitted back (Fig. 6.10). Earlier, Dr William Grey Walter in cooperation with A. Kamp and W. Storm van Leeuwen (Institute of

Fig. 6.8. General pattern of transtelephonic biotelemetry system at Mayo clinic, USA (a – receiving station, b – transmitting station); at the heart of the system Hagen-Larks implementation, USA, 1960s
Medical Physics, Utrecht, The Netherlands) developed and successfully tested the equipment for 8- and 16-channel EEG telemetry at short distance (Walter W., 1969) (Fig. 6.11-6.12).

After the experiment on 25.04.1963, the results of computing telediagnosis with data transmission through the underwater cable and via satellite were compared. For this purpose the same biological data were gradually transmitted. No differences in diagnostic value of both methods were recorded.

In May, sessions of transatlantic telemetry of fetal ECG were held. Prior to these sessions, an experimental transmission of fetal ECG between hospitals in Milwaukee (Wisconsin) and Fort Wayne (Indiana) was performed under Professor Saul D. Larks’ supervision.

Fig. 6.9. General pattern of computing biotelemetry (rheoencephalograhic) system at Mayo clinic, 1960s

Fig. 6.10. Transatlantic computerized tele-EEG consultation, USA, Mayo clinic, Dr R. G. Bickford (behind) and technical experts W. Russert (in the centre) and Don Carroll (Medical milestone, 1963)
On May 7, 1963, “the international cable telemetry” took place: a fetal ECG was transmitted on-line from a mother, being at Mount Sinai Hospital (Milwaukee, USA), to Dr Antoine Remond’s laboratory (Paris, France). On May 28, 1963, at 14.15 (GMT) “the international satellite telemetry” took place – via the Relay I satellite. A fetal ECG was transmitted from Milwaukee to Paris where it was successfully received and recorded for the
further interpretation. On the basis of these findings the concept of international fetal cardiology network was developed. The latter could receive fetal ECG in function of the timetable via cable or satellite communication channels and interpret the data to improve medical aid in perinatology. It was envisaged to establish not less than 12 similar international centres (Larks S., 1965; Ray C. et al., 1965).

On June 25, 1963, a biotelemetry session was held between Mayo clinic (Rochester, USA) and the International conference on medical electronics (Liege, Belgium). The information was transmitted through the underwater cable. Simultaneously, the same data recorded on the cassette were sent to the laboratory of Prof. Antoine Remond (Paris, France) for a comparative interpretation. The results of the distant and delayed immediate analysis coincided entirely (Fig. 6.13) (Ray C. et al., 1965).

The results of all the sessions were thoroughly analysed. The technical requirements of the equipment were defined. The methods of transmitted data integrity provision were developed and the path for practical implementation of transatlantic telemetry was opened.

Fig. 6.13. General schematic diagram of biotelemetry system used for the session between the USA and Belgium 25.07.1963
On July 14, 1965, a successful transatlantic telemetric transmission of electric cardiosignal was fulfilled. Dr James Charles Hirschman in cooperation with Thomas J. Baker and Arthur F. Schiff performed ECG transmission at a distance of 7,500 km from Conakry (Guinea, Western Africa) to Miami (Florida, North America). Physically the data transmission was performed from aboard the *S. S. Hope*, a hospital ship (Fig. 6.14-6.15).

To pick up and record the signal, a “standard, financially affordable and ready for use” equipment of Cambridge Instrument Company, Hallicrafters and Hammerlund radiostations, was used. The entire consulting process of 12-channel ECG took several minutes. The additional data and distant result interpretation were communicated via voice service. During the next week, transatlantic telemetric consultations were held on two more patients, in which case even a tropical storm could not prevent qualitative data transmission.

Some tests preceded the Transatlantic transmission: ECS radio transmission (via amateur radio station) at a distance of 15 km, followed by transmission between Detroit - Miami and Mexico City - Miami (USA). Interferences were determined and successfully eliminated, once the the transatlantic session was held (Fig. 6.16-6.17).

The gained experience was confirmed some months later. ECG radio consultations were held between the states of New York and Florida (distance of 2,100 km) via amateur radio stations. The importance of the method was obvious for medical care on ships at sea, isolated hospitals and emergency situations. The possibility of distant computerized treatment of all possible types of electrophysiological data was discussed. Later on, Dr Hirschman participated in the development of a telemetry system for paramedics (ref. to Chapter “Telecardiology”).
Fig. 6.16. Authentic ECG transmitted via radio from Africa to North America, July 14, 1965

Fig. 6.17. Equipment used for transatlantic ECG telemetry (Africa – North America, 1965)

It is worth adding that in 1973 another experiment was held on board of the SS *Hope*. The ship was anchored on a Brazilian shore. A telemedicine consultation for a patient suffering from lymphosarcoma was received from experts in Washington (USA) via satellite. The conclusion was drawn concerning the possibility to use compact receiving and transmitting equipment for voice and teletype messages exchange, facsimile, patient’s fixed video, X-ray patterns and microscopic pictures and journal articles on ships at sea (Walsh W. et al., 1974).

On May 2, 1965, the first transatlantic medical videoconference was held during which Professor Michael Ellis DeBakey performed an open-heart operative replacement of the aortic valve with an artificial prosthesis on a patient from Chile named Saba Jadue (Fig. 6.18) (DeBakey M., 1995).

The surgery was performed at the Methodist Hospital in Houston (USA). The audience was in the lecture hall of the Medical Department at the University of Geneva, Switzerland. Interactive transmission was performed via the *Early Bird* satellite. During the surgery, Professor DeBakey answered the questions asked by doctors in the audience. Many distinguished doctors (Professor Jean-Claude Rudler, Professor Charles
Mentha and others) and WHO’s Director General, Dr M. G. Candau took part in this remarkable event. The patient in a satisfactory condition was dismissed from hospital after 2 weeks. He told journalists: “Now I can marry because my heart will be strong” (Fig. 6.19).

On July 5, 1967, a transatlantic ECG teleconsultation was held using the computing cardiology system of Dr C. Caceres (ref. to Chapter “Telecardiology”). An electrocardiogram was recorded at the University Hospital, Tours, (France), and then transmitted via satellite telephone channel to Washington (USA) for computerized interpretation. The results of the analysis were transmitted back by telex. The analysis itself took 15 seconds, and the result was received in France within 30 seconds on completion of data transmission in the USA. In fact, the transatlantic computing teleconsultation took as much time as the similar procedure carried out between New York and Washington. In France, this event was organized by Professor Renaud Koechlin (Hospital Foch and National Institute of Healthcare Service and Medical Researches), Dr Gaudeau and biomedical engineering expert Jozef Cywinski (Fig. 6.20). The latter developed a special interface for satellite telediagnostic vectorcardiogram. After successful tests the system was presented to General Charles de Gaulle and members of the French government.

Fig. 6.19. Michael E. DeBakey is performing open heart surgery via videoconference (Houston - Geneva, May 2, 1965), photo of Baylor College of Medicine Archives (Throwback Thursday: DeBakey’s real-time open heart surgery, 2013)
But it was not only the Atlantic which was served by telecommunication. In 1971, the first telemedicine session between countries on both sides of the Pacific Ocean took place. Cooperation between the Mayo clinic (Rochester, USA) and a hospital in Sidney (Australia) was established. At first, a transmission and distant interpretation of ECG from Australia to North America using telephone and satellite connection was performed. And on April 12, 1978, a 45-minute videoconference between the medical centres via two satellites and with the help of microwave data transmission was held (Telemedicine at Mayo, 2015).

On December 7, 1988, a disastrous earthquake happened in Armenia. 21 cities and 350 villages were hit, 25 thousand people died, hundred thousand people were injured. Within 2 weeks after the catastrophe, the USA and the USSR launched the joint project to carry out telemedicine consultations for survivors via satellite communication. Four medical centres provided experts to participate in telemedical sessions with the national diagnostic centre in Yerevan. It is worth mentioning that in the USA there was already experience of using ordinary telecommunication tools in disaster areas as in 1985 NASA implemented for the first time systems based on voice satellite communication for teleconsultation of survivors of the earthquake in Mexico (NASA satellite aids in Mexico City resuce effort, 1985). It is remarkable that the system was launched within 24 hours (Fig. 6.21-6.23) (Grigoriev A., Baevsky R., 2007; Telemeditsina Bashkortostana 2014; Hasbiev S. et al., 2011; NASA Lewis ..., 2014; Nicogossian A. 2001, 2014, 2015).

An unexpected follow-up took place after the industrial disaster in Bashkiria. On June 4, 1989, in the region Asha-Ulu-Telyak two passenger trains collided and a powerful explosion of light hydrocarbons gases occurred in the nearby oil pipeline. 575 persons were killed; more than 600 persons were injured. Immediately, another telemedicine terminal was added to the Ufa medical centre (Fig. 6.24) (ibid). During 3 months, 51 telemedicine sessions were held, in which more than 400 doctors and nurses from both hemispheres took part. 253 patients were consulted at a distance. The sessions were organized as bilateral audio-, video and facsimile information exchange (Fig. 6.25) (ibid).
Fig. 6.21. The head and organizer of telemedicine “spacebridges” on behalf of the USSR – Oleg G. Gazenko

Fig. 6.22. The head and organizer of telemedicine “spacebridges” on behalf of the USA – Arnauld Nicogossian

Fig. 6.23. The head and organizer of telemedicine “space bridges” on behalf of the USA – Ronald C. Merrell

Fig. 6.24. Episodes of transatlantic “spacebridge” Armenia/USSR – USA (1988)
Fig. 6.25. Medical transatlantic (slow scan) videoconference: transmission of static images and sound (Bashkiria, USSR, 1989)

Fig. 6.26. Screenshot of telemedicine consultation project “Telemedicine Spacebridge to Russia”
Later on, the project was named “Telemedicine Spacebridge to Russia”. Before 1993 as part of its strategic framework, store-and-forward teleconsultations via the Internet were performed. Specially developed dynamic web-applications were tested and various types of medical multimedia information channels were employed (Fig. 6.26) (Grigoriev A., Baevsky R., 2007).

The potential offered by desktop-videoconferences also enabled the usage of this technology for real-time teleconsultations and distant lectures. At the end of the 1980s, transatlantic telemedicine for the first time ever allowed to bridge not only the geographical distance but political barriers as well.

6.2. Polar Telemedicine

Over decades of Arctic and Antarctic exploration, radio teleconsultations were the only means of distant medical support.

It should be noted that radio in Antarctica was used for the first time in the expeditions of Sir Douglas Mawson in 1911-1914 (Australian Antarctic Division, 2015).

In the USSR in 1970, during the 15th Antarctic expedition, a remarkable event took place – the first experimental transmission of a range of electrocardiograms from Mirnyy observatory in Leningrad was carried out (Gorbunov G. et al., 2008; Deryapa N. et al., 1975; Senkevich Yu., 2004). This can be considered as the beginning of telemedicine application for healthcare support of the Antarctica polar explorations.

A year later (during the 16th expedition) doctors at Molodezhnaya station established a connection through phototelegraph with the polar medicine department of the Arctic and Antarctic Research Institute in Leningrad. On three occasions, expedition doctors received efficient radio consultations based on the electrocardiograms of a patient with acute myocardial infarction sent from Antarctica (ibid). It should be noted that the quality of the transmitted phototelegraphic ECG and messages was rather low due to less sophisticated technical devices available at that time, and also due to the long lasting transmission time. The time of data transmission ranged to from 20 to 40 minutes. But these were the first technical and organizational attempts of monitoring of polar explorers’ health and to organize distant medical consultations to the poles.

In 1974, an article about telemedicine implementation linked to the Australian Antarctic expeditions was published (Lugg D., 1974). It revealed the application of facsimile connection for diagnosing and treatment selection. The expedition doctor sent black and white X-rays prints to the polar medicine centre via fax. The answer came as a text, but when
necessary, a voice message was sent via radio (Australian Antarctic Division, www.aad.gov.au 2015).

More widely, telemedicine started to be used as a support of polar explorers in different countries from the mid-1990s and later. Over decades radio connections remained the key telemedicine tool in Polar Regions of Europe and North America (Fig. 6.27).

The telemedicine network created on the territory of the state of Alaska (USA) is worth mentioning too. There is an earlier fact about radio consultation in this territory. A newspaper article from 2 September 1933 (An Epic of the Air …, 1933) describes a radio telemedicine support in the following way: «In Seattle, early that Thursday morning, Ed Stevens, operator of amateur station W7BB, received a call for help. He was engaged in a conversation with the operator at Alitak, more than 1000 miles away. At lonely Lazy Bay on Kodiak Island, five-year-old Henry Loof lay near death with appendicitis. Stevens described the little boy's symptoms to Dr. A. H. Seering of Harbor View Hospital, Seattle. The physician diagnosed the case, warned of the danger of peritonitis, urged that the boy be taken to a hospital at once…Stevens called the United States Army Alaska Telegraph, which used both wireless and cable, and the message was relayed through to Anchorage, a circuit of 2000 miles. Pilot Harry Blunt took off at once through the storm, together with Dr. Walkowsky. Twice the seaplane was forced down. Twice the intrepid duo again roared into the gale. Late that afternoon they reached Lazy Bay, 400 miles from Anchorage. They were just in time to save the little boy's life» (Fig. 6.28).
So, there is written evidence that on August 31, 1933 the amateur radio consultation was conducted between extremely isolated areas in Alaska with participation of ham operator Ed Stevens on one side, and medical doctor A. H. Seering assisted by Cyril Pemberton, the operator at Alitak, at the other. Both wireless and cable lines were used for this communication. After the teleconsultation the famous Alaskan pioneer pilot Harry Blunt (aka «Bristol Bay Sea Hawk», 1889-1985) brought Dr Walkowsky to the patient side for an urgent surgery (An Epic of the Air …, 1933; DeSoto C. Calling C., 1941).
After a systematic start in the 1950s, the Alaska radio communication was actively used for medical purposes. Residents of small villages had the possibility to connect with the hospital for ordinary voice consultations. In 1955, a range of technical standards was issued, which helped substantially upgrading radio stations network and improving their work. In 1964, a training program on emergency medical aid for volunteers from small villages and rural settlements was launched. These persons also used radio communication for regular meetings and consultations with doctors responsible for certain areas. During 3 years, the volunteer network significantly increased, despite of the fact that new hospitals were built. In 1968, official timetables and radio consultations schedules were adopted. The attending doctors were bound to connect with the supervised settlements and to guide volunteers’ consultations. A specific term, “radio-medical-traffic” appeared, pointing at the significant amount of medicine information transmitted via radio channels. The presence of at least voice communication with medical staff had already seriously impacted on the fact that assistance was available and timely. However, because of atmosphere ionization, radio communication suffered constant interruptions and interferences (Fig. 6.29) (Alaska Federal Health Care Access Network Telemedicine Project, 2004; Brady C., 2015; Foote D., 1977; Spain P. et al., 1977; Foote D. et al., 1976).

In the same year on Senator Mike Gravel's initiative, several stations with satellite communication were launched in Alaska (ATS-1 satellite, launched on 7.12.1966). Initially the new communication tool was mainly used for distant teaching of doctors and volunteers. In 1971, a health care system started in Alaska under the auspices of the Bureau of Indian Affairs (BIA). During a short period of time, hospitals in seven settlements were opened and from their creation onward they were equipped with shortwave radio-devices. BIA sent special standardized medical kits to the small settlements and the same radio stations for connection with hospitals. Simultaneously a program of telemedicine consultations via “Doctor Call” satellite communication was officially opened. In the summer of 1971, nineteen settlements received satellite communication sets and managed to activate this telemedicine network, which was officially launched with the involvement of Governor Egan and Senator Stevens in September (ibid).

Satellite links were used at scheduled times in the morning, and in emergency cases – out of schedule. Expert centers were created in Tanana and Anchorage hospitals, and also at the University of Alaska. Satellite communication was protected from the ionization interference. This triggered a quadruple increase of “radio-medical-traffic” as compared to the ordinary radio. On average about 250 telemedicine consultations were held
annually (as a rule, 2 consultations per a patient). Approximately 280
meetings took place to address organizational and logistics problems.
Distant educational consultations were actively carried out. They resulted in
improvement and simplification of decision taking related to transportation,
patients’ transfer, decrease in number and period of hospital admissions,
etc. (ibid).

On May 30, 1974, the ATS-6 satellite was launched. Thanks to it the
health care system in Alaska received more advanced, stable and accessible
system of audio and video communication. A special project, the Alaska ATS-6
Washington-Alaska-Montana-Idaho (WAMI) Telemedicine/Education experiment was launched. The goal of the project was to study technical and clinical suitability of broadband satellite
technologies to address health care issues. The new equipment was installed
at hospitals. Available videoconferencing allowed a better interaction
between hospitals and nurse outpatient clinics, in far distant and hard-to-
reach settlements. The Alaska telemedicine network functioned under the
supervision of Dr Martha R. Wilson (head of the medical centre for
indigenous population), Professors Heather E. Hudson, Charles D. Brady.
Dr Dennis R. Foote (The Academy of Education Development,
Washington, USA), held the technical consultations and assessed the
telemedicine usage efficiency of the ATS-1 and ATS-6 satellites for Alaska
(Fig. 6.30-6.31) (ibid). All points of the new telemedicine network used
interactive videoconferencing. Tele-ECG and stethoscopes were also
employed for tele-auscultation (“stethophone”) in Fort Yukon and Galena.
Simultaneously the first medical information systems began to be formed
(Fig. 6.32-6.34) (Bradly C., 2015).

A specific schedule for clinical telemedicine sessions was set up for
every settlement (60 minutes, 3 times a week). During 104 days, 325
teleconsultations were held on paediatrics, internal medicine, orthopaedics,
surgery, ophthalmology, gynaecology, dentistry, ototorhinolaryngology,
radiology, dietology and recovery treatment. There were emergency
teleconsultations in cases of acute injuries and coronary syndrome. In
addition to videoconferencing, tele-ECG, teleradiology and tele-auscultation
were implemented. The average length of video-teleconsultations was about
12-15 minutes, while radio consultations lasted for 3-6 minutes. A specific
line of activities was distant learning, interactive telelectures, sometimes
supported by video record transmission (Alaska Federal Health Care Access
Network Telemedicine Project, 2004; Brady C., 2015; Foote D., 1977;
Fig. 6.30. Martha R. Wilson

Fig. 6.31. Geography and Alaska ATS-6 telemedicine experiment resource base

Fig. 6.32. Telemedicine consultations in 1974 (Anchorage, Alaska)
Technical sustainability, sufficient diagnostic quality of physical examination and X-ray images transmission, standard security level, an important positive clinical effect were determined in terms of efficiency. On basis of the data collected, the model of regional multilevel telemedicine aid system was developed. It is worth noting that black and white as well as colour videoconferences were held via the ATS-6 satellite in 1974-1975 and 1977-1978, respectively. Unfortunately, because of the irregular functioning of the satellite, the experiment was terminated at some point, and the search for alternative means of telecommunication was started.

In 1972-1976, in Alaska, various telephone lines were laid, which also improved communication between hospitals and patients. Round-the-clock duties for emergency consultations through telephone were organized. By 1984, the installation of the telecommunication network was completed and radio communication became a much better alternative. In 1985, slow-scan TV systems were installed at three hospitals, which again helped holding videoconferences for clinical and learning purposes. At the end of the 1980s, faxes and digitizers were in use for distant document management, i.e. to transmit X-ray images through telephone lines. The quality of data transmission was bad and doctors immediately abandoned this application. Later on, modern digital telemedicine tools began to be actively used in Alaska.
In conclusion: just a couple of additional facts about the use of ATS-3 satellite. After the earthquake in Mexico (20.09.1985) radio amateurs (refer to chapter 1.2.4) contributed to the rescue operations within a day. The National Aeronautics and Space Administration (NASA) used telecommunication technology to provide disaster aid. The ATS-3 communications satellite provided critical voice communication support for the international rescue and relief efforts of a few medical organisations. Within 24 hours of the disaster, ATS-3 gave priority to satellite communication traffic involving disaster assessment and emergency rescue operations (Aeronautics and Space Report of the President 1985 Activities, 1985). «ATS-3… was instrumental in relaying communications of relief organizations after the earthquake in Mexico and the volcanic eruption in Columbia… ATS-3 is a useful communications tool in support of relief efforts, such as those that occurred after the earthquake in Mexico City and the volcano eruption in Columbia». ATS-3 also provided emergency communications links (including medical issues) after another Mexican earthquake in 1987 and during St. Helens volcano eruption in 1980 (ibid).

6.3. Mobile Telemedicine

In 1967, NASA started the project “Integrated Medical and Behavioural Laboratory Measurement System (MBLMS)” on creation of systems for medical aid, health care, carrying out biomedical analyses and bioscientific experiments for spacecraft crews and distant settlements on Earth. In 1971-72, for the first time operating telemedicine systems including audio- and video communications, broadcasting of vital functions (cardiovascular and respiratory systems), transmission of data, X-ray images, biochemical and microscopic findings were implemented as a part of the project (Lockheed to develop IMBLMS ground test unit, 1972; Rfp on IMBLMS, 1972). The research on potentials to use such systems in remote and rural areas was carried out. This preliminary resulted in a unique project, named “STARPAHC” (Space Technology Applied to Rural Papago Advanced Health Care). The project was aimed at providing medical assistance to the residents from segregated and remote areas via mobile telemedicine system (Freiburger G. et al., 2007; Fuchs M., 1979; Starpahe Systems Report, 1977 a) b)) (Fig. 6.35-6.36).

The project was implemented in the Indian reservation of the Papago tribe, situated in Southern Arizona. For the first time, mobile medical cabs (cars), equipped with telemedicine systems, apart from standard diagnostic and therapeutic equipment, were developed. The project covered approximately 14 thousand residents of 75 settlements. Every mobile health unit (MHU) gave the possibility for color and black-and-white
videoconferences (television connection format, including micro medication and X-ray patterns demonstration), voice connection, computerized information exchange channel. Satellite communication channels were used alongside with land telephone lines (Fig. 6.37) (ibid).

Fig. 6.35. General view of the mobile telemedicine complex (mobile health unit – MHU) of the STARPAHC project (1970s, USA)

Fig. 6.36. The concept of STARPAHC telemedicine system
Over a period of two years, 3,648 persons sought for medical care in MHU. Telemedicine sessions were held for 439 cases (12%), videoconferences were held only in 3.5% cases. Telemedicine sessions included teleconsulting, tele-X-raying, real time patient examination, video microscoping. The most frequent reasons for teleconsultations were traumas (38%), skin diseases (27.9%), metabolic and hemodynamic disorders (21.4%). Most efficient was the usage of telemedicine to treat fractures, injuries, throat diseases, skin ulcers, snake bites, respiratory infections and gastroenteritis as well as for minor surgery. It was established that telemedicine consultations were either urgent or important and useful for patients’ treatment in 86.3-97% cases (for videoconferences – 78.3%). The technical efficiency was characterized as acceptable in 85% cases (Fig. 6.38) (ibid). As a whole, the project resulted in clearly defined high organizational, moral and clinical efficiency of telemedicine system usage for health care in segregated and rural areas.

In 1974, the NASA supervised the first in-depth investigation into diagnostic and technical efficiency of a telemedicine system to define standardized requirements for remote medical diagnosis applications (Davis J., 1974). For the first time, the engineering requirements for telemedicine systems were scientifically substantiated and harmonized.

In 1973-1979, in Alabama, a project on the usage of two minibuses, equipped with telemedicine appliances to provide medical care in 17 sparsely populated districts was implemented. Every minivan team included a highly qualified nurse, a laborant and technician-driver. Facsimile and computerized tele-ECG system were used for data transmission.
In the early 1980s, in USSR/Russia, the *Avtosan-82* mobile computerized laboratory was developed under supervision of Professor Roman M. Bayevskyy. The work was performed by experts from the Institute for Biomedical Problems, Russian Academy of Sciences and Moscow Regional Research Institute (Russia) (Fig. 6.39) (Adamovich B. et al., 1990; Baevskyy R., 1970; 1979; Baevskyy R. et al., 1978, 2008; Grigoriev A., Baevskyy R., 2007; Deryapa N. et a., 1975; Parin V. et al., 1967).
The *Avtosan*-82 was a diagnostic laboratory, mounted on a bus and to a certain degree copying the structure of systems of medical and physiological researches on board of the *Salut*-7 space station. It was equipped with the range of instruments similar to the system for medical monitoring of cosmonauts. Besides it included a computer which was similar to prototype of the on-board medical computers, mounted on the *Mir* space station just 5-8 years before (Fig. 6.40) (ibid). The *Avtosan*-82 mobile laboratory marked an important step forward not only in space equipment and methods usage in the “Earth” medicine. First and foremost a new health assessment methodology, the pre-nosology diagnostics, was developed. It is directed at studying individual stages in-between norm and pathology. This new scientific and practical approach was created to assess cosmonauts’ functional state. This nosological approach, based on the diagnosing of known diseases, appeared to be unsuitable for space medicine. The reason is that cosmonauts were selected among the healthiest candidates and did not represent the most appropriate experimental subject group.

The most prominent features of the pre-nosology approach were cardiovascular system assessment methods as indicators of personal adaptive reactions as well as the examination of vegetative regulatory mechanisms. The above allowed disorders to be registered far ahead of the appearance of clinical symptoms. In fact, this system was a powerful tool for telemedicine screening. *Avtosan*-82 was used in factories and rural areas for a preventive examination of the population, with the usage of both, standard medical methods and the newest space technologies. The results received were transmitted to the analytical centre in Moscow through different communication channels, i.e. radiotelemetry, teletype, telephone. Operational conclusions were given to the subject via the computing unit of the mobile laboratory. This was the first experience of space technologies application in the health care practice (Fig. 6.41) (ibid).
Fig. 6.41. Tele-screening examination on board Avtosan-82 (1980s, Russia)

Regular research with the Avtosan-82 mobile laboratory and units of the Vita-87 type, that followed, allowed determining that approximately 70% of the population was in relatively good health. The introduction of space technologies and the pre-nosology approach allowed to assess the pathology development pattern and to take timely the necessary preventive actions (ibid).

So, satellite communication technologies have been a unique telemedicine communicative tool enabling to quickly pass from ordinary experiments on biological data transoceanic transmission to the fully-featured distant medical care of entire regions. The mobile telemedicine concept formed at that time, proved quickly its efficiency and it is in use till now.

References


[16] DeBakey M. Telemedicine has now come of age, Telemedicine Journal, 1995, 1, 1


[22] Fuchs M. Provider attitudes toward STARPAHC: a telemedicine project on the Papago reservation. Med Care, Jan 1979, 17, 1, pp. 59–68


[28] Lockheed to develop IMBLMS ground test unit. Nasa Press Release N72, 1972, p. 2


[34] Nicogossian A. E. Medical Informatics Presentation, www.nasa.gov.ua


[40] Rx by Overseas Radio, Electronic Age, 1924 July, p. 22


Afterword

One can emphasize that the present achievements of telemedicine reflect what once was science fiction.

For example, in 1955, the film "Flight to the Moon" by K. Artseulov and L. Zhigariov showed a quite interesting prediction of cosmic biotelemetry systems (Fig. 1).

Fig. 1. "Flight to the Moon" USSR, D-372-55, "Diafilm" Factory, 1955

And in 1962, in the Soviet Union, Viktor S. Saparin, science fiction writer and journalist, described in his book "The First Watch" a global telemedicine system and telesurgery (Fig. 2) (Saparin V., 1962).

In the 1920s, in the USA, writer Neil Ardley, in his book "Health and Medicine (World of Tomorrow)", asserted that in future all patients would "communicate" only with a computer, transmitting their complaints to the expert systems and undergoing self-examination. The physicians would examine patients only in extreme cases and surgery would be "put on the shoulders" of robots (Fig. 3) (Ardley N., 1982).
However, the most significant and well-known prediction regarding telemedicine was a series of publications by the writer and editor Hugo Gernsback, who is considered as the father of science fiction. In the 1920s in the United States, he described multiple devices and technologies in his novels and short stories, including those that we now call telemedicine tools - videoconferencing, telesurgery, telemetry, electronic prescriptions, etc. (Fig. 4) (Fips. Radio Doctor – Maybe, 1924; How telemedicine has already surpassed our earliest predictions, 2013).

Fig. 2. Telesurgery predicted by Viktor Saparin in 1962 (illustration author I. Ushakov)

Fig. 3. Computing diagnosis of the future and telesurgery according to Neil Ardley
**Fig. 4.** Hugo Gernsback / Gernsbacher

**Fig. 5.** Gernsback’s systems for remote handling and telesurgery, illustrations from the journal "Science and Invention”, 1920s

**Fig. 6.** Illustration of Gernsback’s prediction of biotelemetry and telediagnosis, "Science and Invention”, 1920s
In particular, the possibilities of modern telesurgery were also predicted by Hugo Gernsback. He described an instrument called «teledactyl» (from Greek "tele" meaning “at a distance” and "dactyl" - finger), which allowed the physician to remotely carry out inspection and palpation of the patient, and perform medical manipulations (Fig. 5-7) (ibid).

An illustration to the article "Radio Doctor - Maybe", published on the cover of "Radio News" in April, 1924 became quite famous. It showed an amazing telemedicine system, which was a brilliant prediction of medical videoconferencing, remote diagnosis and e-prescribing.

It must be mentioned that Fips, the author of the article "Radio Doctor – Maybe", was a "Head office boy" (Fig. 8) (How telemedicine has already surpassed our earliest predictions, 2013). This article is a kind of semi-fiction work dedicated to the invention of the system, though its value is questionable. But the "Radio Doctor" image itself on the cover of the magazine became a historic symbol of telemedicine.
Fig. 8. Cover of Radio News magazine (1924) with the image of the "Radio Doctor" system, which became a historic symbol of telemedicine (left) and scheme of telemedicine system from the original article (right). (The magazine is part of Dr. A. Vladzmyrsky’s personal collection)

References

**Short Biographies**

**Abseitova Saule R.** Candidate of Medical Sciences, Assistant Professor, founder and chief doctor of Shymkent Regional Cardiac Centre, Kazakhstan. In 1985 consultative trans-telephonic tele-ECG RDC was established upon her initiative on the basis of Shymkent EHS Hospital.

**Adey William Ross** (31.01.1922, Australia – 20.05.2004, USA); an outstanding neurophysiologist, Professor of Physiology and anatomy, designed the first electroencephalograph in Australia, used general-purpose computers for automated EEG analysis. He was the author of more than 300 research works in the field of brain electrical activity.

**Akhutin Vladimir M.** (26.03.1924-09.11.2005; Russia), engineer-captain 1 rank, Candidate and Doctor of Engineering (1971), Professor (1972), the chief and primary constructor of State Scientific Institution "The Scientific and Research Technological Institute of Bioengineering Systems" in St. Petersburg. Award "Honored Science Worker of Russia" (1995). In June 1941 after the graduation from Leningrad Naval Special School he entered F. E. Dzerzhinskiy Higher Naval Engineering College. In October of the same year joint the battlefield and was injured several times. In 1942-1946 he continued his studies. From 1948 to May 1968 was engaged in scientific research, constructive and military activity in the field of designing the new equipment for the Navy. In 1964 organized and headed the first research laboratory of biomedical cybernetics in the country, which since 1968 was transformed into a Specialist design department of biological and medical cybernetics and even later became "The Scientific and Research Technological Institute of Bioengineering Systems". Akhutin was Director of this Institute till the end of his life. V. Akhutin is the founder of a new scientific field - the theory of bioengineering systems, in which biological elements and systems of different complicity can integrate in appropriate way with technical facilities. Akhutin’s team developed the mathematical techniques of current diagnostics and living organism forecasting on the basis of automatic data processing from bio subjects in real time. Based on the above research, unique systems of automated control and management of a human health under extreme conditions (i.e. prolonged deep diving, long duration space stays, etc.) were developed. Under the supervision of Akhutin and with his direct participation the space flight support systems were performed. He is an author of 12 monographs and manuals, 157 articles, 48 inventions; under his guidance more than 30 governmental research, design and engineering developments were carried out. Akhutin was awarded 21 state grades, including the Academician S. P. Korolyov medal and Yu. A. Gagarin commemorative medal, laureate of the Lenin Prize (1959) and state prize of Russia (1991).

**Akulinichev Ivan T.** (02.07.1915-02.01.2000; Russia), Candidate of Medical Sciences and Doctor of Medical Sciences, Professor, Associate Member of International Astronautic Academy, the inventor of vector-cardioscope, one of the founders of medical radio-electronics, the main developer of telemetric medical
control systems of (MCS) for space flights. He maintained personally Yury A. Gagarin's MCS functioning. Akulinichev received technical education, in 1941 graduated from Omsk Medical Institute and volunteered to the war; served as a head of a hospital train, ended the war in Berlin, held the rank of Colonel of Medical Service. In the 1960-1970s he took part in the development of the methods and devices, which were used at cosmonauts training and maintained the control over their health conditions during the flight, medical supply of space flights on the Vostok spaceship. He was an employee of the Institute of Biomedical Problems, a famous public person, schematic-based analyzer and author of numerous scientific works, 20 inventions; honored with awards and medals such as Distinguished Service Medal (Order of the Red Star), for labor and scientific achievements (Order of the Red Banner of Labor); a holder of golden medal of Christopher Columbus, etc.

Akulova Maria V. Honoured Doctor of the RSFSR, Chief Physician of Orenburg Region, one of the RDC founders and active workers in the Regional Clinical Hospital in 1979.

Almazov Vladimir A. (27.05.1931-04.01.2001; Russia) went to a primary village school, then to the secondary school 1 of Toropetsk. In 1948 entered the first Leningrad Medical Institute n.a. Academician I. P. Pavlov. Doctor of Medical Sciences, Professor, Academician of Russian Academy of Medical Sciences (1995), during 47 years of his work at the St. Petersburg State Medical Almazov contributed greatly to the training of high quality medical doctors. The clinic of the Faculty Therapy department, which he headed from 1971 to 1997, developed as a multifunctional medical establishment. Almazov laid the basis of the cardiology scientific school, which served as a foundation for the Scientific Research Institute of Cardiology of the Ministry of Health of the Russian Federation in 1980. A remote diagnostic centre was arranged at the Institute, where specialists analysed ECG transmitted over telephone communication lines. In the late 1980s, the procedure of using remote diagnostic centre for mass screening in groups was developed and implemented under the supervision of Professor V. Almazov. He is the author of 300 scientific works, including 25 monographs and internal diseases training manuals. 60 candidate and 25 doctor theses were defended under his supervision. In 1998 V. A. Almazov was appointed to the grade of Honoured Science Worker of the Russian Federation. In 1996 the International biographic centre (Cambridge) awarded him a medal and certificate "For outstanding achievements in medicine of the XX century".

Amlinger Phillip R. (10.08.1911-21.11.2002; USA), a physician, an employee of the University of Missouri Medical Center, the author of a number of conceptual and practical articles on telecardiology, one of the founders of the tele-ECG network in Missouri.

Andrus Scott W. (10.08.1938-19.05.2013; USA) graduated from college, and then from the New York University, received a doctorate in physics. In the 1970s he was a consultant to the Massachusetts General Hospital on telecommunications. He is the author of a series of pioneering works in the field of teleradiology. Andrus
studied the issues of optics, image transmission, and developed a number of medical devices. He was the author of the book on religion and science “Being, Meaning, and Breath”, and also a spiritual and religious leader.

Ascalonov Arthur A. ((born on 04.11.1940), Doctor of Medical Sciences, Professor, in 1981-1990 - Head of the Department of Health of the Altai Territorial Executive Committee (Barnaul), the territorial tele-ECG network was organized under his supervision.

Avdeeva Galina P. (born on 1.10.1941, Honored Doctor of the Russian Federation, Chief Doctor of the State Cardiological Dispensary, Cheboksary; consultative tele-ECG RDC was established in the dispensary under her supervision.

Barashnev Yuri I. (born on 21.09.1929), Doctor of Medical Sciences, Professor, Honoured Worker of Science of the Russian Federation; after graduation from the department of pediatrics he studied at clinical residency; then worked at the Institute of Pediatrics of the AMS of the USSR*. In 1970 he headed the country's first Department of Clinical Genetics, later was a Deputy Director for Science of Moscow SRI of Pediatrics and Pediatric Surgery. Barashnev was dissertation advisor of 40 doctoral and candidate theses, author of more than 300 scientific publications and 9 monographs.

Barr Norman Lee (31.08.1908-26.04.1979; USA), Captain, Head of the Aero Medical Space Research Laboratory of the US Navy. In 1929 he graduated from flight school, served 2 years in the Air Force, and then worked as a civilian pilot. In 1933-1937 he was trained at the Georgetown University School of Medicine, and then - at the naval postgraduate medical school, where he received the qualification of a flight surgeon (1939). In 1942 he graduated from the naval aviation school. N. Barr was a veteran of World War II. Since 1950 he headed the Aero Medical Space Research Laboratory of the US Navy, where a number of important scientific and practical projects were implemented during 9 subsequent years. Captain Barr was one of the founders of biotelemetry in the United States. Under his leadership, a biotelemetry system for space flight was designed, built and proved in practice. The system was successfully tested during the stratospheric flights. In 1960 Navy awarded him a Certificate of Exceptional Service in recognition of his extraordinary achievements, as well as for his numerous other significant contributions to aviation medicine.

Bartůněk Petr (born on 23.8.1939; Czech Republic), Candidate (1989) and Doctor of Medical Sciences, Associate Professor. He graduated from the Faculty of Medicine of Charles University (Prague, Czechoslovakia/Czech Republic) in 1969, undertook a postgraduate residency in internal medicine and cardiology. His professional activity was related with the 4th Clinic of Internal Medicine of the Medical Faculty of Charles University. He was a doctor, a senior registrar, head of the departments of cardiology, internal medicine, intensive care unit. Also he repeatedly served as deputy dean and dean of the Faculty of Medicine. In the 1980s together with colleagues from the Czech Technical University developed and implemented TELSAR, a system of trans-telephonic ECG diagnostics. He was the
founder and editor of a number of scientific journals in the field of public health; public figure. He is author of 90 scientific publications, 4 monographs and 5 textbooks, a writer of science fiction on medical subjects as well.

Bayevskyy Roman M. (born in 03.08.1928; Russia/USSR), Candidate and Doctor of Medicine Sciences, Professor, Honored Science Worker of Russia, Academician of International Academy of Astronautics, Academician of International Informatics Academy; one of the founders of aerospace cardiology and creator of systems of automated prenosological diagnostics. In 1953 he graduated from military medical faculty at the Saratov Medical Institute and was posted to serve in the Far East and Sakhalin. During that time a portable ballistocardiograph was invented. In 1959 Roman M. Bayevskyy received an appointment to the Institute of Space Medicine. Since March 1964 he has worked at the Institute of Biomedical Problems. Roman M. Bayevskyy personally carried out the development of the medical control system, performed the selection of the diagnostic techniques and the construction of airborne hardware of Yu. A. Gagarin's space flight. Due to his inventions number of cardiological methods were applied in the space for the first time ever, in particular ballistocardiography and seismocardiography, to study myocardial contractile function, Holter recording for the assessment of ECG changes during a day, etc. He contributed significantly to the fulfilment of the first research of spacemen's coordinating motions via hand-operated dynamography. At the beginning of the 1960s the first centre for medical telemetric information reception was arranged by R. M. Bayevskyy. Over the last years under his guidance the study of autonomic regulation of heart and respiratory system of the crew members of the International Space Station was carried out. He implemented the achievements of space medicine to the Health care system. As early as in the 1960s he offered the technique of heart rate variability analysis to study autonomic regulation of blood circulation under the condition of a space flight. In the subsequent years this method was used widely in different fields of clinical practice and applied physiology. Using the experience of cosmonaut research, he worked out the absolutely new approach to the health level assessment, which got the name "prenosological diagnostics". Bayevskyy is a member of editorial boards of research-to-practice journals; the dissertation advisor of 30 Candidate and 5 Doctor theses; the author of 20 monographs and manuals, 400 scientific works, 12 certificates of authorship; was awarded medals and 12 Distinguished Service Medals (Order of the Red Star), for labour and scientific achievements (the Badge of Honour Order, Yu.A. Gagarin commemorative medal), etc.

Belknap James Walter (11.05.1858-06.04.1927, USA) began to practice in New York in 1886 in the Medical College of Columbia University and the New York Academy of Medicine. He was an attending physician in Presbyterian Hospitals; in Columbia University Medical School; in 1892 he passed from Clinical Lecturer to Professor of Clinical Medicine; he was an active member and leader of national and regional medical and health societies and committees.

Bennett Donald (1929-29.01.1996, USA); graduated from Military Institute and Medical faculty, in 1961-1965 served in the army. For 9 years headed the EEG-lab
at the Utah University. From 1974 till 1986 was a Professor of Neurology in Nebraska and Creighton Universities, after that up to 1995 - an Honourable Professor and a member of American Academy of Neurology, the author of numerous works and a classical monograph on brain drowning (1980).

**Benschoter Reba Ann** (1930), Doctor of Medical Science (1978), Professor, worked in the University Medical Centre in Omaha, Nebraska for 40 years; held the position of the Director for Biomedical Communications.

**Beskrovnyy Ivan M.** (born in 1930, Russia), Doctor of Engineering, Professor, since 1957 worked in the institutes for Nuclear Research and Physics, since 1973 he was a Director of computer centre of Directorate General for Health Services in Moscow, worked on the methodological basis development for creation of automated control systems (ACS) for metropolis health care. In the period 1977-1970 he was a Deputy Director of ACS Scientific Research Institute, later worked in the ACS Scientific Research Centre of the Ministry of Radio Industry. Since 1985 he was Professor of Medical Cybernetics in the Department of Russian National Research Medical University (RNRMU) named after N. I. Pirogov; author of 220 articles and 6 books.

**Bird Kenneth Timothy** (1918-13.02.1991; USA) graduated from Harvard University and Medical School. He passed the Korean War as a captain, and then more than 40 years worked at the Massachusetts General Hospital, at the beginning as a consultant, doctor-pulmonologist, Project Coordinator, then - as Director for Telecommunications. He was also a teacher and an associate clinical professor at Harvard University, headed the medical service of Logan Airport. Bird initiated the creation of the Boston - Logan - Bedford telemedicine network in 1968-1970. He is the founder of the methodology for the videoconferencing use in medicine, author and co-author of the first scientific evidence-based research on the effectiveness of telemedicine. Bird also developed other information technologies, for example - colour photography of disease symptoms and signs for medical records as an alternative to hand-written history.

**Borovkov Nikolay N.** ((born on 26.01.1940, Russia) Doctor of Medical Sciences, Professor, Honored Doctor of the Russian Federation, held the Chair of Hospital Therapy of Nizhny Novgorod State Medical Academy, Chief Physician of Volga Federal District; rose through the ranks from an attending doctor to the head of the Therapeutic Clinic of Nizhny Novgorod Regional Hospital named after N.A. Semashko. In the 1980s actively studied the problems of automated remote cardiac diagnostics, formulated the principles of organization and operation tele-ECG centres at the outpatient level of health care; author of over 600 scientific publications, 3 monographs, 33 manuals, 6 patents; dissertation advisor of 6 doctoral and 33 candidate theses; holder of medals and commemorative tokens).

**Bosscha Johannes** (18.11.1831-15.04.1911; The Netherlands), Doctor of Sciences (1854) Professor, Academician (1863), physicist; graduated from the Latin School in Amsterdam, was enrolled at the University of Leiden, in 1854 received his doctorate for research in the field of the galvanometry. After internship in Germany,
he returned to work at the Department of Physics at Leiden. In 1860 he headed the Department of Natural Sciences at the Military Academy of Breda and 3 years later became a full member of the Royal Academy of Sciences. He dedicated lots of efforts to the development of higher education system. In 1873 he was appointed the head of the department of physics at the Delft Polytechnic Institute, and from 1878 to 1885 was the Director of this Institute. In 1905 he invented the tele-ECG method (together with Wilhelm Einthoven). In his later years he held the post of secretary of the Dutch Society of Sciences, and contributed a lot to the development of international scientific relations. He is the author of many scientific papers on acoustics, galvanic polarization, electrolytic reduction, thermodynamics as well as of a three-volume textbook on physics (1875).

**Brisker Arthur** (15.07.1902-01.07.1976; USA), a physician, almost all his life worked in New York, an inventor of a number of auscultation devices. He is known as a talented musician, who had adapted some of I.S. Bach's musical pieces for piano.

**Caceres Cesar Augusto** (USA), MD., one of the founders of computer telecardiology, executive director of the Institute of Technology in Health. In 1953, Dr. Caceres obtained his pre-medical and medical degrees from Georgetown University, for 3 years worked in internal medicine, specializing in cardiology. He was engaged for the Public Health Services, where he developed the U.S. first functional computer-electrocardiographic interpretive system. Later Caceres joined George Washington University where he was Professor of Clinical Engineering. As a clinical professor he taught at the Georgetown University. He was one of the first doctors who dealt with AIDS patients in 1982. He coined the term "clinical engineering" in 1969. Caceres published over 100 scientific articles, textbooks and inventions and patented an electronic stethoscope. He won numerous awards and prizes, including two "Superior Service Awards".

**Carnazzo William Anthony** (23.05.1915-19.06.2003), worked as a practitioner from 1938 to 1990. He was a Director of training of paramedics in Trauma Center, Omaha, since 1975. Dr Carnazzo was a prominent physician, social activist and educator.

**Chavpetsov Viktor F.** (07.07.1947-16.11.2011), Doctor of Medical Sciences, Professor, Honorary Figure of Russian Higher Education, headed the medical business administration research department of St. Petersburg Research Institute of Cardiology Since the beginning of the 1980s. He actively participated in the creation, operation and analysis of the effectiveness of tele-ECG RDC, was the founder of the original scientific school, the developer of the automated technology of healthcare quality expertise; author of more than 150 scientific publications, including 4 monographs, dissertation advisor of 6 doctoral and 33 candidate theses.

**Chireykin Lev V.** (1931-2002; USSR-Russia), Doctor of Medical Science, Senior Researcher, Head of Laboratory / Department of heart rhythm disorders of the Leningrad Institute of Cardiology, scientific consultant of the Northwest Centre of diagnosis and treatment of arrhythmias (St. Petersburg). He was the founder of
scientific telecardiology, organized and studied the work of network television ECG in the Leningrad Region, developed a methodology for telemedicine consultation in cardiology in the 1970-1980s.

**Chumakov Aleksandr A.** (born on 04.05.1941, Kazakhstan / USSR), Candidate (1972) and Doctor (1989) of Medical Sciences, Professor, Honored Doctor of the Russian Federation. In 1958, after graduating from high school, he entered the medical faculty of the Orenburg State Medical Institute. After graduation in 1964, he worked as a surgeon in public health practice. In 1968 was enrolled in graduate school at the department of general surgery of the Yaroslavl Medical Institute, which he successfully finished in 1971 and defended his thesis on "Diagnosis of acute peritonitis with the help of a computer" (1972). From 1971 to 1973 Alexander Chumakov worked as the head of the department of remote diagnostics at emergency hospital in Yaroslavl. Later he joined the Yaroslavl State Medical Academy, being promoted from a teaching assistant to Professor and the head of the Department of surgery (since 1991). He is the author of over 300 scientific papers, under his guidance 3 doctoral and 18 master's theses were defended. For long-term and conscientious work he was awarded with honorable mention at the Academy, of Yaroslavl Region "For Merits in Science".

**Conrath David W.** - Professor, holds a doctorate in business administration; for 25 years working at the Faculty of Engineering at the University of Waterloo. He also had permanent positions at the faculties of engineering and business at other universities of Canada; was the Dean of the College of Business at San Jose State University (USA); a businessman and public figure.

**Cooley Austin G.** (1900 - 07.09.1993, USA); a telecommunications expert who helped developing the fax machine. He held more than 75 patents on methods and equipment for the transmission of weather maps, medical X-rays and facsimile text and pictures.

**Corbin Charles** - professor, headed the department in Kansas City University, then for over 20 years worked in Arizona University, a creator of the Physical Education conception, globally appreciated; the author of more than 200 publications, 70 books, numerous video films, devoted to fitness, received numerous awards.

**Cywinski Jozef** (born on 13.03.1936), a Pole by ethnicity, emigrated to the USA in 1967, waiting for emigration documents, was in France for 6 months, where he took part in the transatlantic ECG tele-session performance. Later on he participated in the development of numerous biomedical tools, pacemakers, various electrical stimulators of body tissues, etc.; lived in the USA, Switzerland, then in France; IEEE member and the author of more than 100 articles, 2 books and 12 patents.

**DeBakey Michael Ellis** (07.09.1908-11.07.2008), modern cardiosurgery founder, a physician, scientist and lecturer, developed coronary artery bypass methodologies, prosthetics of valves and artificial heart implanting. He received the doctor’s diploma in 1932, undertook an internship in Europe, had military and medical service. From 1948 till 1993 worked at Bailor Medical College, rose
through the ranks from the Surgery Department Head to the President and Chancellor of the college. DeBakey was the author of numerous scientific articles and inventions, honoured with the national and international awards.

**Dimond Edmunds Grey** (8.12.1918-3.11.2013; USA), MD., Professor, founder of the University of Kansas School of Medicine. After leaving school in 1937, he started working at the factory and at the same time entered the college in Indiana. Being a very good football player, he received an offer of admission to Purdue University and in 1941 he was transferred to the University of Indiana. In 1944 E.G. Dimond received his medical degree, served in the army (troops of the U.S. Army in Japan), where he headed the cardiology service. During 10 years he headed the Department of Cardiology of the Kansas University Medical Centre. In 1950, he headed the cardiology laboratory of the Medical Centre of the Kansas University, where under his leadership; the original tele-ECG system was developed and successfully put into serial production. Nine years later Dr. Dimond founded and headed the Institute for Cardiopulmonary Diseases at the Scripps Clinic (California) and was a special consultant on medical education to the Department of Health, Education and Welfare, Washington, DC. In 1961-1962 Dr. Dimond was elected a President of the American College of Cardiology. He conducted great public work in the establishment of friendly relations between the US and China and was an outstanding educator in the public health care system. Dr. Dimond was the author of over 1000 scientific articles, essays and audio recordings, including 18 books.

**Dovgalevskyy Pavel Ya.** (born on 26.11.1947; USSR), director of the Saratov Research and Development Institute of Cardiology of the Ministry of Health and Social Development of the Russian Federation, Professor, Candidate (1983) and Doctor (1997) of Medical Sciences, Vice-president of Society of cardiology of the Russian Federation, honored cardiologist of Russia (2005). After the graduation from the Saratov State Medical Institute in 1971 he embarked upon a career at the emergency hospital, then - at the Saratov Municipal Hospital (in 1978 he headed the cardiological department). In 1981 Dovgalevskyy started a simultaneous work at the Saratov State Medical Institute Clinic. In 1994 he headed Saratov Scientific Research Institute of Cardiology. A lot of techniques of telemedicine information technologies for prevention and treatment of cardiovascular diseases were developed by Dovgalevskyy. He was one of the initiators of the arrangement of remote telemedicine cardiological centres in Russia, established the transmitions of ECG. He promoted the application of ECG auto transmission method (domestic monitoring) in order to monitor patients, who suffered from acute myocardial infarction. P. Ya. Dovgolevskyy developed the methods of myocardial infarction forecasting and heart rate variability during exercise testing. Dovgolevskyy is an editorial board member of many research and practice journals. He is the author of more than 300 scientific works and 12 invention patents. Under supervision of Prof. Dovgolevskyy 21 candidate and 7 doctor theses were defended.

**Dreyfuss Jack R.** (1923-25.01.1985) – Professor of Radiology in Harvard Medical School; employee of Massachusetts General Hospital; graduated from Harvard School and the Taft University School of Medical; worked at Massachusetts...
General Hospital for 25 years; author of over 50 scientific papers (including those on the history of radiology) and a traditional educational book on radiology, community leader.

Dunn Earl V. - Professor, received his medical degree in 1960, completed his residency training on family medicine in the USA, then he practiced medicine in rural area in Canada. For over 30 years he has been employed at the University of Toronto, Canada.

Einthoven Wilhelm (21.05.1860-29.09.1927; The Netherlands), Doctor of Medicine (1885), Professor, psychologist, founder of electrocardiography, Nobel Prize Winner in Physiology and Medicine (1924). He received his medical education at the University of Utrecht; then worked in the Eye Care Clinic, where he actively conducted research on the physiology of vision organ and locomotor system. In 1886, at the age of 25, he was appointed a Professor at the Leiden University, which he held for all his life. In 1889, Einthoven began to work in the field of electrocardiography. By 1901 he had designed a string galvanometer, introduced "P-Q-R-S-T-U" nomenclature, described the three standard leads, was the first to prove that the ECGs of various forms of heart disease have characteristic differences; and in 1905 he invented the tele-ECG method (together with Johannes Bosscha). For a number of years Einthoven actively improved his electrocardiograph, tried to establish its sales, and at the same time conducted electro-physiological studies. In 1924 he was awarded the Nobel Prize "for his discovery of the art of the electrocardiogram." He was the author of 127 scientific papers; his research was referred to the ten greatest discoveries in the field of cardiology of the 20th century.

Elsom Kendall A. (1904-1978; US), MD, one of the initiators of the medical equipment for colour medicine television, "TV coordinator" of the University of Pennsylvania, the organizer of many medical video conferences; received his medical degree in 1927 in Pennsylvania, joined the Army, where he served in the rank of major, and then as a Medical Colonel until 1945; he headed a number of departments in the Medical Center of the University of Pennsylvania. In 1961 was appointed medical director of Scott Paper Company. He is author of scientific papers in the field of endocrinology, gastroenterology, nephrology, infectious diseases, public health.

Emeshin Konstantin N. (Barnaul, Russia) one of the RDC founders in the Territorial Clinical Hospital in 1982.

Farooq Jaffer (14.09.1942; India-31.07.1991, USA) – graduated from the Medical University in Pune, India in 1966; from 1969 to 1977 was an employee of the Radiology Department of Massachusetts General Hospital where he got promoted from the resident to the doctor and the teacher; later worked in Arizona at different medical establishments.

Fialko Vladimir A. (born on 17.07.1931; USSR), Candidate of Medical Sciences, Doctor of the highest category. In 1956 he graduated from the Sverdlovsk State Medical Institute (therapeutic and preventive faculty), and then started working for the city ambulance station. In 1962-1969 he became the first head of the
specialized "thromboembolic" substation of the emergency hospital; the chief cardiologist of the city health service department in 1969-1971. He was twice a deputy chief physician at the medical wing (in 1957-1960 and 1978-1988). Since 1971 he worked part-time at the therapeutic departments and later as a doctor methodologist at Emergency hospital, a teacher and one of the organizers of the course "ambulance" in the Ural State Medical Academy of Ekaterinburg. He is one of the initiators and active participants in the organization of specialized Ambulance service in Ekaterinburg (1959-1967) and Tomsk (1972-1978). He created the system of examination of medical errors as part of the Voluntary Group of Experts. In 1978 he organized a remote diagnostic centre and a network of tele-ECG (with V. L. Gabinski). He is the author of more than 190 publications, including 5 monographs, 40 manuals, 1 glossary of Ambulance service and was awarded the badge "Excellent Health" and the Ekaterinburg professional recognition award "Medical Olympus".

Flynn John (25.10.1880-05.05.1951; Australia), Presbyterian minister, founder of Royal Flying Doctor service, one of the telemedicine pioneers. He received religious education at the University of Melbourne in 1907-1910, and was ordained in 1911. He worked in remote and isolated parishes, paying much attention to health care and the creation of rural hospitals. In 1917 he held correspondence with an Australian pilot Clifford Peel, who served in Europe and described the evacuation of the wounded with the help of aircraft in his letters; in the same year Rev. Flynn witnessed history of Jimmy Darcy. Both events, apparently prompted J. Flynn the idea to create an air ambulance service equipped with telecommunication means for medical servicing of isolated and remote settlements. After a long period of searching for funding and support the service was established in 1928 in Cloncurry (Queensland, Australia). It acquired national status in 1934, thanks to intensive work and lobbying J. Flynn. The following years he worked extensively on the development of the network of air ambulance, rapidly moved up the ecclesiastical ladder. He was an award-winner of the British Empire.

Franke Marian (21.03.1877-12.09.1944; Poland-Ukraine), Associate Professor (1908), Professor (1916), Academician of the Academy of Medical Sciences of Poland, a cardiologist and physiologist, founder of the first clinical tele-ECG system. He received his medical degree from the University of Vienna in 1900, after which he worked at the Department of Internal Medicine of the Medical Faculty of the University of Lvov, specialized in Germany and France. In 1914-1921 as a military doctor he served in the Austrian and Polish armies and took part in the military operations in Lvov. From 1921 to 1939 (according to other sources, from 1916 to 1942) he headed the Department of General and Experimental Pathology of the Medical Faculty of the University of Lvov; twice he was also the dean of the Faculty (1928-1929, 1936-1937). In the period 1935-1937 Franke Marian implemented and used the first clinical tele-ECG system (with W. Lipinskiy). He was the author of several scientific papers and textbooks; public figure, the head of professional communities. During the Nazi occupation of Prof. M. Franke was removed from the management of the department, in 1942 he was arrested by the Gestapo; after his release from detention he was for a time restored the rank of professor, and then forcibly sent into retirement.
Gabinskyy Vladimir L. (24.12.1943; USSR), Candidate (1970) and Doctor (1992) of Medical Sciences, Professor, Academician. He graduated from Sverdlovsk Medical Institute, department of general medicine, after that was enlisted to the research work, became one of the first hospital physicians of the new Heart Attack Department. Then he headed the laboratory of functional diagnostics at the Sverdlovsk Medical Institute. After 1975 he headed the Cardiac Centre. In 1978 Vladimir L. Gabinskyy arranged a remote diagnostic centre and tele-ECG network (together with V. A. Fialko). He took part in the development of medical devices and techniques, which were used during the flight of a pilot astronaut Oleg Atkov (was awarded the S. P. Korolyov medal). Since 1980 he worked in Krasnodar as a head of a cardiaic centre and at the same time - as a chief of the laboratory of new methods of diagnostics and treatment of Scientific Development and Production Association "Kvant". Since 1994 he has worked in the USA, where he created and headed Russian and American University, Russian medical centre - the Institute of Medicine and Rehabilitation in Atlanta. Vladimir L. Gabinskyy is the author of 4 monographs, and more than 200 published scientific works. He was awarded honourable badges, prizes, medals for excellence in health protection, medals of the International Academy of Education, Big Star of Peace, with international medal "Knight's White Cross".

Gabunskyy Vladimir L. (Sverdlovsk/Ekaterinburg, Russia), RDC founder at the Regional Cardiac Centre in 1978.

Gardner Reed M. (USA); got the degree of electronic engineer (1960) and the Doctor's degree on biophysics and bioengineering (1968) at the Utah University; worked in hospitals, university clinics and private companies, addressed the issues of health informatics, medical information and expert systems. He was one of the developers of "HELP", hospital data analyzing and decisions support system. Between 1996 and 2005 headed the department of health informatics of Utah University. He is the author of more than 350 scientific works, an award-holder, a public person, a member of the editorial boards of various scientific journals.

Gasparyan Suren Ash. (10.02.1932 – 4.11.2005; Russia), Candidate (1963) and Doctor (1967) of Medical Science, Professor, Honored Science Worker of the Russian Federation, the founder of the first in the world department of medical and biological cybernetics in medical university and in a range of establishments of the field of medical cybernetics; got a degree of a medical doctor in 1957, worked as a head doctor and surgeon. Since 1960 he worked at N. I. Pirogov 2nd Moscow State Medical University. Starting as a post-graduate student he reached the position of a Professor, then a head of department and a vice-rector for education. Since 1974 he was the chairman of the Medical Cybernetics and Computing Technology Board at Academic Medical Council of the Ministry of Health of the Union of Soviet Socialist Republics. In 1977-1985 he was the director of Republic-wide Computer Information Centre; since 1994 - the president of the Health informatics department of the International Informatics Academy; the organizer of 19 Russian and 9 international conferences and forums. Under his scientific editorship 34 collections of research papers were published. He himself was the author of 300 works;
dissertation advisor of 7 doctoral and 36 candidate theses; was awarded medals and orders.

**Gavrikov Konstantin V.** (23.08.1928-21.10.2010; Russia), Candidate (1960) and Doctor of Medical Sciences, Professor. In 1953 he graduated with distinction from the Stalingrad Medical Institute and started to work at the department of morbid physiology at first as a paramedic and then as a teaching assistant. From 1958 to 1968 he worked as an Associate Professor at the department of anatomy and physiology. After that during 28 years he headed the department of Human Physiology. During three years (200-2004) Gavrikov headed the department of anatomy and biomechanics at the Volgograd State Academy of Physical Education. The range of scientific interests of Konstantin V. Gavrikov was rather wide. In the 1960s he developed and realized on practice the original technique of porto-caval shunt with movable ligatures. His master's thesis was devoted to the influence of analeptic and sleeping medicine on immune responsiveness to intestinal and typhic bacteria. Next years of his life were devoted to the study of Advanced Mathematics and to gaining the design engineering skills in original radio aids for medical application. The result was a unique concept and the whole range of biotelemetry radio aids (facilities enabling to enter diagnostic data directly to ECM, programs for computer analysis of medical information, biotelemetry). For many years Gavrikov was engaged in design of special electronic medical and physiological devices. Per totality he was appointed a grade "Master of sport of the USSR on special radio design" in 1972. The practical result of this research was the creation of "Kovyl", medical multichannel digital telemetry system, which united almost all district hospitals of Volgograd Region into one Regional Diagnostic Centre. The system was honored with numerous state awards. In the 1980s Gavrikov supervised the creation of the project of International Congress arrangement "Ecology, life, health" in the Russian Federation, and in the 1990s he worked over the project "Health passport of a human", developed the theory of organization of the united health care and educational informational space as a condition for optimization of population health quality. He was the author of a big range of scientific methodological works, more than 400 scientific works, 3 of them being monographs. Under the guidance of Gavrikov more than 40 candidate and 8 doctor theses were defended. For more than 20 years Professor Gavrikov was a member of the board of the P. K. Anokhin Scientific Research Institute of Human physiology, a member of the central academic committee on Human physiology at the USSR Ministry of Health, a member of the All-Union task group "Mechanisms of the systematic organization of physiological functions". For more than 10 years he also worked as a free-lancer expert of Higher Attestation Commission. In 1994 he was elected an Academician of the International Academy of Sciences.

**Gazenko Oleg G.** (12.12.1918-17.11.2007; Russia), an Academician of Russian Academy of Sciences, Lieutenant General, one of the founders of space biology and medicine. In 1941 he graduated with distinction from the military faculty of the 2nd Moscow Medical Institute and as an army doctor of the 3d rank (a captain of medical service) was sent to the front-line together with other graduates. He served as a chief of tactical hospital during the whole war. In 1946-1947 he had a special
training in Military Medical Academy (Leningrad), and then he was appointed to the Institute of Aeromedicine, where he started working as a researcher, later as a head of the laboratory and a department supervisor, and finally as a deputy director for science. In 1948-1950 he took part in the high-latitude air expeditions of Air Force "Severnyi Poljus-2, 3, 4", repeatedly worked at the drifting stations, islands and the Arctic Ocean coast, and also in Kara Kum and other places hard for aviator service. In 1951-1952 he was committed in the North Korea. Since 1955 O. G. Gazenko concentrated on the research in the field of space biology and medicine, becoming one of the ideologists, supervisors and active doers of the research programs on artificial biological satellites of the Earth. The results of biological and physiological research on the living organisms under the space flight conditions and earth-based laboratory experiments with imitation of the space flight factors allowed justifying the possibilities of manned space-flights, and when the preparation of Yu. A. Gagarin to the flight started, O. G. Gazenko was directly involved in it. In 1969-1988 he was the director of the Institute of Biomedical Problems. Since 1978 he worked on the substantiation and implementation of the comprehensive physiological, hygienic and psychological measures, which supported long-lasting space flights. Upon the initiative and under the supervision of Gazenko the range of international biological investigations were carried out on the dedicated Kosmos bio-satellites. The scientists from Bulgaria, Germany, Czech Republic, Poland, USA, France and other countries participated in these research works. In the 1980s O. G. Gazenko supervised telemedicine project "Space Bridge to Armenia" on behalf of the USSR. In 1988 he retired as Lieutenant General of Medical Service. He was the author of numerous scientific works, books "Animals in the space", "Life and Space", "Space Cardiology", "Humanity and the Space" and others; the organizer and editor in chief of multivolume serial edition "The Problems of Space Biology"; the initiator and coeditor of two revisions of the Russian-American work on space biology and medicine "Foundations of Space Biology and Medicine"; editor of the journal "Success of Physiological Sciences", an editorial board member of a range of journals. In 1987 he was elected the president of All-Union (now Russian) physiological society n.a. I. P. Pavlov. For many years he was also a board member of the International Fund n.a. G. Galileo (USA, since 1982), was one of the supervisors of the committee "Bioastronautics" of the International Astronautical Federation. Gazenko was an awardee of USSR State Prize, awarded decorations and medals for war, labour and scientific achievements.

Gerasimenko Nikolai F. (born in 1950), Doctor of Medical Sciences, Professor, RAMS Academician, Honored Doctor of Russia, received his medical degree in 1973, worked as a surgeon, head of department, chief doctor; in 1980-1985 he headed the medical aviation service department. Gerasimenko was a deputy chief doctor for surgery in Altai Territorial Hospital and took an active part in the development and use of automated telediagnosis systems for surgical pathology. Since 1990 he was employed in administrative and public service; one of the founders of Doctors Improvement Faculty at the Altai State Medical University.
Gernsback / Gernsbacher Hugo (16.08.1884-19.08.1967, Luxembourg – USA); an electrical engineer, inventor, businessman, writer, editor and publisher of numerous popular science magazines, the creator of the term "science fiction".

Gershon-Cohen Jacob (09.01.1899-06.02.1971; USA), MD. (1936), Professor, one of the teleradiology pioneers. He received his medical degree in 1924, trained in radiology, and opened a private practice in 1929. During the Second World War he served in the Navy. Since 1941 he served as a Professor at several universities in the United States, constantly worked as a consultant in many hospitals and clinics; during 1949-1966 he held a position of the Head of the Department of Radiology at the Albert Einstein Medical Center Philadelphia. Gershon-Cohen was a leading specialist in the field of mammography, one of the pioneers of thermography (1962). He is the author of over 400 publications, including 2 classic textbooks on mammography. He was a director of several professional associations, a public figure, honored with national and international awards.

Grey Walter William (19.02.1910-6.05.1977), graduated from college in Cambridge in 1931, worked at the neurophysiological laboratory at hospital in London (1935-1939), then at Barden’s neurological institute in Bristol (1939-1970). Grey participated in many scientific projects, working in the USA, the USSR and European countries; studied the subjects of bio-cybernetics, neurophysiology, brain electrical activity, robotic engineering, made significant contribution into the development of EEG recording.

Guida Guido (11.11.1897-19.02.1969; Italy), a physician, organizer and lifetime director of the International Medical Radio Centre (Centro internazionale di radiocomunicazioni mediche - CIRM). In 1922, he received his medical degree and began working at the department of otolaryngology at the University Clinic of Rome, and in the 1930s he was promoted to the position of Associate Professor, and then of Professor. In 1935, Professor Guida opened and funded CIRM. Guido Guida devoted his entire life to the work in the centre.

Halfen Emmanuil Sh. (26/06/1923; USSR/Azerbaijan), Candidate (1954) and Doctor (1962) of Medical Sciences, Professor, Honored Scientist of the Russian Soviet Federative Socialist Republic (1980), a pioneer of telecardiology and use of cybernetics in internal medicine. After graduating from the Azerbaijan Medical Institute in 1946 he finished clinical residency, worked as a therapist, senior laboratory assistant, and then - as an assistant at the Azerbaijan Institute of Advanced Medicine. In 1963 he was elected the head of the Department of Hospital Therapy at the Astrakhan Medical Institute. After 4 years Emmanuel Sh. moved to Saratov, where he headed the department of the local medical higher school. In 1980 Prof. Halfen was appointed the director of the Saratov branch of the Leningrad Institute of Cardiology. In 1967 he developed a mathematical model of forecasting of myocardial infarction outcomes and in 1971 - the theory and the basic provisions of the automatic control by computer of the cardiac treatment. Since 1967, Prof. Halfen constantly worked on the concept and implementation of the tele-ECG facilities. He is one of the co-developers of the "Volna", initiated the creation of remote diagnostic centres (1972), and regional hospital telemedicine systems based
on them. Based on the achievements of Halfen, the concept of tele-ECG was extended to the entire health care system of the USSR (1983). He is the author of over 300 scientific papers, including 5 monographs (it should be particularly noted the "Progress of biological and medical cybernetics", 1974, which was marked with a diploma and premium of the USSR Ministry of Health). Under supervision of Prof. Halfen 25 theses were defended. Member of the Scientific Council of the USSR Academy of Medical Sciences of All-Russia Research Centre for Cardiology the Scientific Council of the Ministry of Health of the Russian Soviet Federative Socialist Republic, a board member of the All-Russian Society of Cardiologists, therapists. He was awarded the "Badge of Honor".

Haukkamaa Maija (born in 1946), got her medical degree in 1975, an obstetrician-gynecologist, in the 1980s - an employee of Helsinki University Hospital.

Hess Orvan Walter (18.06.1906-05.09.2002), an obstetrician-gynecologist, the United States presidential advisor; invented radiotelemetry monitor of fetus cardiac function. He was the first in the USA to administer penicillin for the patient with scarlet fever. Got the medical doctor certificate in 1931 in New-York, practiced in trauma orthopedics, surgery, obstetrics and gynaecology; military surgeon and WW II veteran; worked at Yale University until 1975. As a public person, he headed a range of professional public societies, was honored with the national awards.

Hirschman Jim Charles (1.03.1931; USA), after graduating from high school he studied chemistry at Harvard University (until 1952) and then received his doctorate in medicine in 1955 in Indiana. He served in the military medical units of the US Navy for three years, and took residency in cardiology after demobilization. Since college years he dealt with the radio issues (he was a radio amateur, headed thematic public societies), and later developed a method of ECG radio broadcasting and spent the first transatlantic electro-cardiosignal transmission, and also participated in the creation of biotelemetric system for rescue services in Miami (USA). Hirschman was one of the organizers of paramedical system in the United States, the ideologist and organizer of emergency medical care. In 2000 and 2001 he spent many hours of tele-consultations over the radio for the victims from merchant vessels, which had been hijacked by pirates nearby the coast of South America. For this outstanding achievement Dr. J.C. Hirschman was honored with "International Humanitarian Award".

Holter Norman Jefferis (01.02.1914-21.07.1983), Professor, inventor of the continuous outpatient ECG monitoring method. He graduated from University of California in 1937, got postgraduate education in Germany and in a number of other universities of the USA. During the World War II served as a senior physicist in American naval forces. In 1946 headed the governmental research group, which tested a nuclear bomb; then he worked in the United States Atomic Energy Commission; since 1964 - a Professor of University of California in San Diego.

Hon Edward H. (1917, China - 06.11.2006, USA); an obstetrician-gynecologist, an employee of Medical College of Yale University, the inventor of
Doppler fetus monitoring and fetus radiotelemonitoring. Initially lived in Australia, in 1945 immigrated to the USA and entered Loma Linda Medical School. After graduation he practiced in obstetrics and gynecology, worked at Yale University; the author of 150 research works, was honored with awards and medals.

**House Arthur Maxwell** (10.09.1926-17.10.2013; Canada), a physician, Professor, politician, founder of the telemedicine centre at the Memorial University of Newfoundland (Canada). He studied medicine at Dalhousie University in 1947-1952; worked as a general practitioner, specialized in psychiatry and neurology, and worked in St. John General Hospital as a neurologist (1960-1997). Dr. House went his way up from an intern to a manager, the head of electroencephalographic laboratory, a member of the hospital board. Since 1968 he held various positions at the Memorial University of Newfoundland (Director of Continuing Medical Education, Deputy Dean, head of innovation and research programs), and from 1977 to 1996 - Director of the telemedicine centre, which later was transformed into "TETRA" (Telehealth and Educational Technology Resource Agency). In 1997 he was appointed Lieutenant Governor of Newfoundland and Labrador. After retirement in 2002 he held the post of honorary professor and participated in the telemedicine projects of the University. He is the author of numerous scientific papers, a public figure, honored by awards and prizes.

**Hunter Charles Hatch** (18.12.1916-08.04.2008), Bachelor of Biological Science (1937), Master of Physics (1939); after the military service during the Second World War he graduated from the Howard University College of Medicine in 1950, later worked as a radiologist in Washington City. From 1971 till 1997, he headed the radiology department of the Hospital for Veterans in Bedford, where took part in the work and scientific assessment of Massachusetts telemedicine network efficiency; later moved back to Washington City where he worked till his retirement in 1991; author of scientific papers, community leader.

**Jutras Albert** (02.10.1900-16.02.1981; Canada), Professor of Radiology, one of the teleradiology pioneers. In 1930-1934 he studied radiology in France at the Radium institute under the tutorship of Marie Curie. On his return to Canada he worked as a radiotherapist, focused on the beam diagnostics of gastrointestinal tract pathology. In 1938 he began to work in the Hotel Dieu Hospital in Montreal, where he soon became a leading expert and the Radiologist-in-Chief. At the same time he taught at the University of Montreal, where he was a Professor and the head of the Department of Radiology for almost 30 years. Albert Jutras was also Dean of the French-Canadian School of Radiology. In 1949 he was guest lecturer at the Sorbonne in Paris (France). His publications are >200, he was an internationally known expert in the field of diagnostic radiology, President of a number of professional associations, public figure, honored by the national and international awards.

**Kamyshyova Evgeniya P.** (born on 28.12.1925; USSR), Distinguished Professor of Nizhniy Novgorod State Medical Academy (NGMA), Professor, Doctor of Medical Sciences, Honored Scientist of the Russian Federation. In 1948 she graduated from Medical and Preventive Cure Faculty of the Gorky Medical Institute.
(GMI), began working as a district physician, and then as a medical intern at the therapeutic department of regional clinical hospital. In 1952 she was enlisted as a teaching assistant of hospital therapy at the GMI on a competitive basis, 1962-1966 she became an Associate Professor, later Professor and then until 2000 - Head of the Department of the Faculty of Postgraduate Medical Therapy of GMI / NGMA. She is an outstanding scientist and public figure. In 1980 under her leadership the standard medical examination model was developed, which included telemetry ECG interpretation and computer-assisted automated analysis. She is the author of over 230 scientific works, including 4 monographs, adapted translation of the "Book about Heart" of the Italian cardiologist F. Burgarello. She was awarded the Order "Badge of Honor", Medal of the Committee of Russian Women, silver medal of Academician I. P. Pavlov, a diploma of the International Biographical Centre of Cambridge.

Kataev Semyon I. (09.02.1904-10.07.1991; Russia), Doctor of Engineering (1951), Professor (1952), Honored Scientist and Engineering (1968), the inventor of modern television, he graduated from the N. E. Bauman Moscow Higher Technical College in 1929, became an electrical engineer, started working at the All-Russian Electronic Technical Institute. In the same year, he filed a patent application for "Device for electric telescopy in natural colours" On September 24, 1931 he filed an application for the invention of television receiving high-vacuum tube, and on April 30, 1933 received a copyright certificate of the USSR No. 29.865. At the same time he held the first image broadcast. In 1932, Kataev worked on a vacuum tube receiver with magnetic focusing of the electron beam, and the next year he improved the receiver box - iconoscope. Later he patented transfer of "electronic image" from conductive photocathode to dielectric material (inventor's certificate dated September 30, 1933, as a priority of February 20, 1932). In 1936, he travelled to the United States for a few months to share experience, where he met V. K. Zvorykin. In the 1950s he worked on satellite communication technologies. Until 1987 he worked at the department of television at the Moscow Electronic Technical Institute of telecommunications, which now bears his name. He is the author of scientific articles and fundamental works "Cathode-ray television tubes" (1936) and "Fundamentals of Television" (1940). In 1944 he, together with a group of professionals, offered the world's first TV broadcasting standard for 625 lines, which is still used nowadays. He trained more than ten Doctors and more than 50 Candidates of Engineering and was awarded the Order of the Red Banner of Labour and medals.

Keller Vladimir S. (1928-1998; Ukraine & Bulgaria) got his Ph.D. in 1959 and EdD in 1975; Honored coach of the USSR; graduated from Lvov State Institute of Physical Education, rose through the ranks from a teacher to the head of a department at this Institute. From 1962 till 1976 he was a manager of the USSR national fencing team; formed the research area of fencer training; the author of more than 150 scientific publications and three books, the holder of a golden medal "For scientific achievements; in 1989 moved to Bulgaria, where he worked in the Council for Mutual Economic Assistance.
Kharitonov Rem A. - Candidate of Medical Science (1961), got the doctor's degree in 1954, since 1957 has worked at V. M. Bekhterev Scientific Research Institute of Psychoneurology and from 1970 to 2004 headed the pediatric psychoneurological/psychiatry department.

Khorev Aleksandr N. (born on 1948; USSR), Candidate (1980) and Doctor (1992) of Medical Sciences, Professor (1995), graduated from the Yaroslavl State Medical Institute (YASMI) in 1972. In 1977-1980 was a postgraduate student at the Department of General Surgery. Since 1976 he has worked in YASMI, and has worked his way up from senior laboratory assistant to the professor of the Department of surgery (since 1993). In 1970 he participated in the creation and operation of the remote diagnostic centre of acute surgical pathology. Since 2000 he has been working as the chief physician of the medical unit of Novo-Yaroslavl oil refinery. He was the author of about 180 scientific papers.

Knowles John H. (1926-1979), Professor, Director of Massachusetts General Hospital. At the time of his management (1962-1972), a telemedical network was established and a number of significant projects in this field were implemented. He received a Doctor’s Degree in 1951; after the residency and the military service, in 1959, he started working at MGH and got promoted from the Head of Department to the Director; author of 25 articles and 5 books, community leader in medicine.

Kobazev Igor V. (Bryansk, Russia), founder and head of diagnostics automated methods department (with RDC) at the Regional Hospital No.1 in 1983.

Konevskyy Anatoliy G. (born on 30.01.1921; USSR), Doctor of Medical Sciences, Professor, a veteran of the Great Patriotic War. After leaving school he entered the Faculty of Philology of the Leningrad University. In 1941 he was mobilized, went through the war, demobilization he returned to his homeland in the Rostov region, worked in a coal mine as a surveyor. Sometime later he was admitted to the first year of the Stalingrad Medical Institute. After graduation he worked as a doctor in rural hospitals, and 4 years later became an assistant of the department of operative surgery and topographic anatomy of the Volgograd State Medical University. From 1963 to 1988 Konevskyy headed the department. At this time, the department focused on the development of students' practical skills, which was provided greatly with a good experimental base: operating unit for 3 tables, vivarium and autopsy examination. The problem of organ transplantation became the main scientific line of the department. The functional, immunological and morphological aspects of this problem were studied. There is an interesting fact: In 1970 at the All-Union Symposium on organ and tissue transplantation (Volgograd), the members of the department accompanied their performances with demonstration of animals with transplanted hearts, kidneys, second head and replanted limb. Photo of a two-headed dog, operated by Professor Konevskyi, surpassed all known newspapers of the world. In parallel with the experimental studies of organ transplants Professor Konevskyy headed the work on the creation and practical implementation of "Kovyl" health telemetry system, designed to provide remote diagnostic and consultative assistance in cardiovascular diseases to all treatment facilities of Volgograd Region. He is an award-holder: Order of "Patriotic War", "Badge of
Honor", Medal "For Merit to the Medical University" I degree, the medal "For the Victory over Germany in the Great Patriotic War", a golden medal of All-Union Exhibition of Achievements of National Economy at the International Exhibition "Health Care-80", 2 silver medals of All-Union Exhibition of Achievements of National Economy of the USSR, commemorative medal and personalized watch for the establishment of surgery in Kalmykia, the medal "For Merit to the Fatherland» II degree, a medal named after Academician I. I. Artobolevskiy "For Merit to educative activities", medal "For Distinction in patriotic activities"; by National Association of reserve officers unions he was granted the title of laureate of Public Vocation Forum.

**Kupriyanov** (8.02.1893-13.03.1963), Academician and Vise-President of the Academy of Medical Science of the USSR, honoured man of science, General-Lieutenant; founder of the largest school of surgeons, anesthesiologists and resuscitators.

**Labutin Vadim K.** (Russia) Doctor of Engineering, an engineer. He is the author of numerous publications and visual aids on radio engineering and bionics. In the 1970s he carried out works on the development and construction of information and diagnostic systems for ECG automated analysis. In the article "40 million books for radio amateurs" (V. A. Burlyand, E. T. Krenkel - http://www.oldradioclub.ru/radio_book/mrb_hystory_02.html) was underlined: We remember how the participant of the VI All-Union Extension Radio exhibition Sergeant re-enlistee Vadim Labutin came to our editorial office. He gave to MRL [mass radio library - author's note] description of visual aids on radio engineering, which he had developed (issue No. 24, 1949). Then Labutin did not have a completed secondary education. A Leningrad school boy, who lost parents and shelter from the Nazi bomb, he joined the army after finishing the 9th grade. Now he is our well-known author. In 1967 he published an interesting work on bionics "Hearing sense and analysis of signals" (issue number 636) which had written together with A. P. Molchanov. This year, Vadim K. Labutin is preparing a doctoral thesis.

**Larks Saul D.** (1910-24.01.1984), biophysicist, studied electrical engineering at the University of Illinois, worked at Marquette University, then as Professor of physics and physiology at the University of Missouri, invented electrohisterograph in 1959.

**Lindberg Donald A. B.** (born in1933, USA), MD., Professor, Director of the National Library of Medicine (NLM) USA, one of the pioneers of computer technologies in health care, studied mathematics at Amherst College (until 1954), graduated in 1958 from the Columbia University College of Physicians and Surgeons. After the residency in 1960 he started to work at the University of Missouri, where he was promoted from an assistant to a professor of Computer Science and Pathology, Director of the Informatics group. During this period, together with Dr. P. R. Amlinger he implemented the tele- ECG network, conducted automation of the clinical laboratory of pathology. Since 1984 he headed the U.S. NLM. Lindberg is the first president of American Medical Informatics Association.
AMIA), a member of the editorial boards of numerous scientific journals, head of many federal projects in the field of medical informatics, author of over 200 scientific publications and 3 monographs. He was awarded numerous national and international medals and prizes.

**Lipinski Witold** (30.11.1886 - 27.09.1955; Poland), Professor (1940), infectious disease physician, a creator of the first clinical tele-ECG system. In 1909 he received a degree in engineering in Germany, and in 1914 - a doctor's degree in Austria, after which he was called up for military medical service. Until 1921 he served as a military epidemiologist. After the war for 5 years he was a director of the State Institute of Hygiene and, at the same time, a teaching assistant of Experimental Medicine department (Krakow, Poland). In 1925 he moved to Lvov and headed the department of infectious diseases of the State General Hospital. During 1935-1937 he implemented and used the first clinical tele-ECG system (with M. Franke). For a number of years W. Lipinsky worked at the Medical Faculty of the University of Lvov; in 1940 he became Professor, in 1940-1941 and 1944-1946 was in charge of the Department of Infectious Diseases. In 1946, as a result of repatriation he left Ukraine and lived in Lodz (Poland) until the end of his life, where he headed the Department of Infectious Diseases at the Medical Academy. He was the author of about 60 scientific papers.

**Manning George William** (1911-2.10.1992) received his medical degree in 1940, worked in practical healthcare, after defending his thesis was appointed at the University of Western Ontario. He was actively working in the cardiology department of the University Hospital and became a leading expert in the field of electrocardiography in the region during 1947-1986, author of over 100 articles and 3 books, scholar and public figure.

**Matusova Aleksandra P.** (17.05.1919-26.03.2010; Russia), one of the clinical pioneers in implementation of cybernetics to cardiology, after the defending the Doctor thesis Matusova worked as a Professor in the department of Intermediate Level Therapy, and from 1962 (according to other sources, from 1967) to 1983 headed the department of internal diseases No.2 of general medicine faculty at the Gorky State Medical Institute (now - Faculty of General Medicine and Nursing of the Nizhny Novgorod State Medical Academy). Under her leadership, the department started applying electronics and computer technologies, automation and mathematical methods - the main lines of medical cybernetics - in scientific and practical purposes. Alexandra Matusova played a major role in the development of the regime and the treatment of acute myocardial infarction, her works were associated with the conduct of patients in the sub-acute stage of myocardial infarction; she also described the course and treatment of Dressler's syndrome. On her initiative the first Cardiac Remote Diagnostic Center was created in Gorky with the reception of information from medical institutions of the city. An automated diagnosis of angina pectoris, pre-infarction syndrome, menopausal myocardial dystrophy and forecasting of the outcome of acute myocardial infarction were developed. Methods of mathematical prediction of fatal complications of myocardial infarction, angina pectoris patients programmed maintenance, diagnostic and
prognostic programs for early forms of coronary heart disease were created too. Using mathematical methods the routes of dispensary management and rehabilitation of patients were defined under her supervision. The Department worked in collaboration with the Scientific - Research Institute of Applied Mathematics and Cybernetics, Radio Physics, Institute of Applied Physics of the Academy of Sciences, Research Institute "Instrument Engineering". The department had a group of mathematicians (M. Haymovich, V. Gladkov, V. Borin et al.) and a group of physiologists. A. P. Matusova is the author of 180 scientific papers, two monographs, five collections of scientific works of the department, 4 handbooks for doctors and medical interns. Under her leadership, 3 doctoral, 20 master's theses were defended.

Mazur Nikolay A. (USSR), Candidate (1966) and Doctor of Medical Sciences (1975), Professor (1982), Head of the Department of Cardiology of the Russian Medical Academy of Postgraduate Education, graduated from Beijing Medical University; 1962-1966 - Clinical residency and postgraduate studies at the Institute of Therapy of the Academy of Medical Sciences of the USSR; 1966-1968 - the Chief Therapist of Ministry of Civil Aviation and the head of the therapy department of the Central Clinical hospital of MCA; 1968-1971 - Senior Researcher of the central research laboratory at the Emergency Treatment Hospital of the 4th Chief Directorate of the USSR Ministry of Health. In 1971-1975 he was a Senior Researcher, and in 1975-1976 became a Deputy Director for Science of A. L. Myasnikov Research Institute of Cardiology. During his work at the institute he organized a remote tele-ECG diagnostic centre. From 1976 to 1979 he worked at the All-Union Cardiology Research Centre. Then Nikolay Mazur organized and headed (until 1987) the Department of Clinical Pharmacology at the A. L. Myasnikov Institute of Cardiology. Since 1987 he has been the Head of the Department of Cardiology of the Central Institute of Medical Doctor Improvement, Russian Medical Academy of Post-Graduate Education of the Health Care Ministry of the Russian Federation. He is the author of over 300 scientific papers, 10 books, co-author of 9 patents. He trained more than 40 candidates and doctors of medical sciences. Mazur was a laureate of the State Prize of the USSR, "Honored Worker of Science", was awarded three medals and was a member of the Russian and European Society of Cardiologists.

Merrell Ronald C. - Professor, received doctor’s degree in 1970, worked as a surgeon, took positions of Professor, dean, clinical director of telemedicine programmes at a number of universities in the USA, for years cooperated with NASA and Ministry of Defense on the problems of space medicine and telemedicine; honoured with awards, a member of Editorial Boards of many scientific journals, a public person, the author of 380 scientific articles.

Murphy Raymond L. H. graduated from New York University; medical practice; Professor of Taft University since 1966; headed the Pulmonology Department of Faulkner and Lemuel Shattuck in the city of Boston, Massachusetts. In 1975 he founded and headed the International Lung Sounds Society. Retired in
1998 and established a company in the sphere of digital auscultation; author of over 50 scientific papers, including those on computer analysis of auscultation.

**Myhre Jon R.** (05.02.1915), got his Medical degree in 1941, headed the laboratory at the University Clinic in Haukeland, was awarded the King of Norway awards for his work in the sphere of telemedicine at sea.

**Nagel Eugene L.** (born on 12.08.1924, USA) is a pioneer of pre-hospital care in San Francisco, Professor. After graduating from high school in 1943 he joined the army; in 1949 received a degree in electrical engineering, and in 1959 became a certified doctor. After residency and specialization he started to work in the anesthesiology department of the School of Medicine at the University of Miami, where he worked until 1974 before receiving a professor's degree and becoming the head of the office at the University clinic of the University of Los Angeles. Nagel worked at a similar post in Baltimore (1977-1980), at the University of Florida and San Francisco (1980-1996). At the end of the 1960s together with James Hirschman he developed and implemented a radio telemetry system for emergency service workers. Nagel is the author of the first paramedic training program. The techniques of cardiovascular resuscitation, chest compression technique, methodology of skill training were special lines in his work. He is the author of numerous publications and textbooks in the field of cardiology, emergency medicine, intensive care, emergency care arrangement. Nagel is a prominent public activist, consultant of the Department of Health Care of the USA. He was honored with numerous national awards and prizes.

**Neyko Eugeniy M.** ((7.10.1932-24.05.2010) Doctor of Medical Sciences, Professor, Academician, Rector of Ivano-Frankovsk National Medical University; in 1986 tele-ECG RDC was opened under his supervision at the Regional Clinical Cardiology Dispensary.

**Neymark Yuriy I.** (24.11.1920-11.09.2011; Russia), Candidate (1947) and Doctor (1958) of Technical Sciences, Professor (1961), Academician of the Russian Academy of Natural Sciences (1991), Honored Scientist of Russia, the founder of the Department of Control Theory and Dynamics of Machines at the Gorky/Nizhny Novgorod State University (GSU). In 1944 he graduated with honors from the Physics and Mathematics Faculty of GSU, finished postgraduate study. In 1958 became the head of department of Computational Mathematics and dynamics of machines, which had been founded by him. In 1963, he participated in the organization of the Faculty of Computational Mathematics and Cybernetics, headed the department of management theory and dynamics of machines on the faculty. Neymark was one of the organizers of the Research and Establishment Institute of Applied Mathematics and Cybernetics. In collaboration with the Gorky State Medical Institute he first outlined a range of issues of using computer technology to diagnose diseases, forecast disease progression and outcome prediction of surgical interventions and to optimize the choice of treatment. Also new efficient coding techniques for large amounts of continuous information data and, in particular, electrocardiograms were offered; decisive rules, specific algorithms for diagnosis, prognosis and to optimize the treatment of cardiovascular, cancer and other diseases
were developed. He was the author of about 600 scientific papers. Under supervision of Yu. I. Neymark, more than 57 candidate and 17 doctor theses were defended. Neymark was the winner of the International Prize of Norbert Wiener on cybernetics, was awarded the "Badge of Honor" and medals of Tsiolkovsky, Popov, Keldysh; in 2007 he received a golden medal and the title of "The Genius of the 21 century" by the American Bibliographical Society, was included among two thousand outstanding intellectuals of the planet by the International Bibliographic Centre in Cambridge.

Nicogossian Arnauld (born in 1936 in Dnepropetrovsk, USSR/Ukraine), in 1945 his parents immigrated to Iran, then to the USA. Received doctor’s degree in 1964, Master of Aerospace Medicine, Professor. From 1971 to 2003 took different positions at NASA, related to space medicine and biotelemetry, simultaneously taught at a number of universities in the USA and Russia; honored with dozens of awards, a member of Editorial Boards of many scientific journals, a public person.

Nose Yoshiaki ((born in 1944) received his medical degree in 1969, PhD in 1973, went from the resident to the head of the Department of Medical Informatics at the Kuyshu University (1987), editor in chief of «Japan Journal of Medical Informatics».

Papakonstantinou George K. (born in 1942), Professor at the National Technical University of Athens, PhD (1971), a specialist of the international level in the field of electrical and computer engineering, author of over 100 scientific articles and 9 manuals.

Parin Vasily V. (5(18).03.1903-15.06.1971; Russia / USSR), Candidate and Doctor (1941) of Medical Sciences, Professor, a member of the Academy of Sciences and the Academy of Medical Sciences, Academician-Secretary, a member of the Presidency and the Vice-President of the USSR Academy of Medical Sciences; an outstanding scientist, one of the pioneers of medical electronics and cybernetics, creator of many methods of biotelemetry and mathematical analysis of functional parameters using computer technology, the founder of space cardiology. Parin graduated from the Medical Faculty of the Perm State University in 1925, in 1927-1933 he worked in the alma mater, having risen from lecturer to professor, department chairman of physiology and dean. In 1933, Parin was enlisted to work with the Sverdlovsk Medical Institute as the head of the department Human physiology, which had been organized by him. At the same time he performed a great administrative work (1933 - Dean, 1934 - Deputy Director for Research and Academic Affairs, and from 1940 - Director of the Institute). In 1941 he was promoted to Professor, the department chairman and the director of the I. M. Sechenov 1st Moscow Medical Institute. In 1942 Parin was appointed Deputy People's Commissioner on Science of Health Care Service of the USSR. During the Great Patriotic War, he organized the epidemiological service in the republics of Central Asia, the evacuation of medical institutions of the North Caucasus, the restructuring of the system of higher medical education in line with the objectives of war. In 1943-1944, Parin with N. N. Burdenko spent most of the work on the establishment and organization of the Academy of Medical Sciences of the USSR.
On February 18, 1947 after returning from a four-month trip to the United States he was arrested on charges of spying for the United States; spending more than 6 years in prison, released on October 29, 1953 and fully rehabilitated on 13 April 1955. Main positions: 1954-1956 - Head of the Laboratory of Pathophysiology of the Institute of Therapy of the Academy of Medical Sciences of the USSR; in the 1956-1960 - Head of the Department of Clinical and Experimental Physiology of the Central Postgraduate Medical Institute; In 1960-1965 - Director of the Institute of Human and Pathological Physiology; 1965-1968 - Director of the Institute of Biomedical Problems; 1969-1971 - Head of the Laboratory of Management functions of the human body and animals of the Academy of Sciences of the USSR. In 1957, Parin was elected an academician-secretary of the USSR Academy of Medical Sciences; in 1960-1962 - Member of the Presidium of the USSR Academy of Medical Sciences; 1963-1966 - Vice-President of the Academy of Medical Sciences of the USSR; In 1966 he was elected a full member of the Academy of Sciences of the USSR and Deputy Academician-Secretary of the Department of Physiology, of the Academy of Sciences of the USSR. Parin is a founder of space bioradiotelemetry, he personally escorted Yuri Gagarin to the pad of space port and was directly involved in the medical examination of the first cosmonaut. He was the author of numerous scientific publications, a member of the editorial boards of scientific journals, including the founder and first editor in chief of the journal "Space Biology and Medicine", under his editorship in 1971 the book "Biological telemetry" was published.

Patrushev Vasiliy I. (25.12.1910-22.04.1962), Doctor of Biological Sciences, Professor, Director of the Ural branch of Academy of Sciences; in 1947 he organized first experiments on ECG radiotelemetry in Sverdlovsk.

Pruett Carl Eugene (17.06.1920-22.01.1991; USA), Captain of the U.S. Navy. As senior medical officer, he served in a number of US Navy ships in the 1954-1957. In the late 1950s - early 1960s he worked in NASA projects related to aerospace medicine (including "Mercury"); headed a group of medical support, which worked with the biotelemetry systems in the program of stratospheric flight (later, these systems were used during manned missions into space). In 1969-1970 he was President of the Society of Illinois.

Radyuck Oleg M. (1931-9.10.2013; USSR-Russia), Candidate of technical sciences, an outstanding leader, who made a great contribution to the development of Research and Production Enterprise (RPE) "Almaz" Saratov, a developer of tele-ECG system "Volna", on October 29, 1965, at the age of 34 years Oleg Radyuk was appointed director of the Federal State Unitary Enterprise "RPE "Almaz". In this position, he worked for 30 years - until November 14, 1995. More than forty years of his life Radyuk devoted to electronics industry, having risen from an ordinary engineer to the Director-General. In 1987 he was appointed the chief designer of one of the scientific and technical areas of the industry. The special merit of Oleg Radyuk included the development and implementation at the company quality assurance system of the implementation of scientific research and production. Oleg M. Radyuk was Commander of the Order of Lenin, the Order of the October
Revolution, the Order of the Red Banner, the Order "Badge of Honour", laureate of the State Prize (1980), "Honorary Radio Operator of the USSR" (1991), author of over 40 scientific publications and inventions.

Ray Charles Dean (01.08.1927-21.08.2011), gained higher technical education in 1952, and higher medical education in 1956, underwent a training course at the Mayo clinic, worked as Assistant Professor at the John Hopkins University, then ran medical engineering departments at Hoffman-LaRoche and Medtronic companies, headed hospitals in Virginia and Minneapolis. He was an inventor. One of his achievements was the artificial invertebral disc. He was a co-founder of numerous medical professional associations, author of 340 articles, 53 patents in the USA and more than 100 international patents.

Remond Antoine (15.01.1917-05.07.1998), doctor, scientist, neurologist and electrophysiologist, from 1939 he worked on topics related to electroencephalography. In 1947 he organized and headed EEG and neurophysiology laboratory at the Paris Hospital de la Salpetriere; took part in medical experiments of the Apollo space programme (USA), studied problems of biofeedback and was the author of more than 500 scientific articles.

Rosewell C. Williams (died in 1976), pastor, professor, worked at Creighton University since 1945, Head of Department of Journalism in 1948-1956, later worked as Communications Director till his retirement in 1973. Understanding the importance of television technologies, he introduced them in the educational process, trained the employees of radio and TV broadcasting companies, equipped training classes with cable telecommunication, initiated the use of teleconferences in teaching medicine and organized the first telesurgical conferences.

Rowen Burt (30.03.1921-01.10.2012; USA), US Air Force Colonel. In 1942 he graduated from Lafayette College, served in the infantry, then entered and successfully completed the accelerated course of New York University College of Medicine. Since 1945, he served as a military doctor. Later he studied at the School of Aviation medicine. He did military service in various military units, including in Western Europe. In 1955 he attended special course at National Naval Medical Center, and then assigned to Flight Test Center, Edwards, California (1956-1962). He was responsible for evaluating life support systems in numerous projects. At the same time, he was medical director of the X-15 program, under his supervision biotelemetry systems were developed and used to control a pilot state in suborbital flights. He was deputy commander of Aerospace Research Laboratory. Also, he participated in the Vietnam War. In 1972-1974 he commanded the School of Health Care Sciences at Sheppard, and then served as Chief at the Medical Standards Division. He retired in 1986.

Rozenblat Vladimir V. (09.12.1927-30.04.2000; Russia), Candidate (1953) and Doctor (1964) of Medical Sciences, Professor (1966), Academician of the Russian Academy of Medical and Technical Sciences (1996), the founder of the sports radio telemetry, he studied at the Sverdlovsk Medical Institute, and in the years 1950-1953 finished clinical residency at the Sverdlovsk Institute of Physiotherapy and Health
Resort. From 1953 to 1960 he was an employee of Sverdlovsk Municipal Medical and Sports Clinic. Here he held the positions of: the doctor of medical control of the clinic, the head of the laboratory of medical radio-electronics. In September 1960, Rozenblat was elected the head of the laboratory of functional diagnostics of the Sverdlovsk Research Institute of Hygiene and Occupational Diseases on a competitive basis. Since 1966, concurrently he served as Professor of Physiology of Labor at the Economics Faculty of the Ural State University. V. V. Rozenblat was one of the greatest scientists - physiologists of labor, widely known for his work on fatigue and physiological norms. A special place in the scientific work of Vladimir Rozenblat was occupied by biotelemetry (radiopulsophone, telemetry of heart rate, respiration, brain bio currents). He was an activist of the arrangements of medical-sports service in the Urals. Rozenblat was a founder of "Sverdlovsk bioradiotelemetry group." Rozenblat worked in various institutions (the Research Institute of Occupational Health, Institute of National Economy, the Forestry Institute, etc.). On his initiative, all divisions and groups involved in the further development of the equipment for dynamic bioradiotelemetry, were created. Suffering from innate process of atrophy of the optic nerves of both eyes from childhood, Rosenblat got completely blind in the early 60s, but that did not stop him from continuing his active scientific and social activities. Since 1961, when regional scientific medical society for physical therapy and sports medicine was formed, he became his permanent chairman. Being already blind, Vladimir V. Rozenblat defended his doctoral thesis. The main scientific activities of Rozenblat were: developments in applied physiology (physiology of muscular activity, labor and sports), the problem of creating biotelemetric equipment and its use in human physiology and clinical findings. He was awarded the Diploma of Honor and two silver medals of All-Union Exhibition of Achievements of National Economy, was the author of over 400 scientific papers (including 4 textbooks, 4 inventions and 3 monographs, one of them was a conceptual work on sports radio telemetry); prepared 5 doctors and 32 candidates of sciences. The movie "Waltz-Boston" about prof. V. V. Rozenblat was filmed by Rotenberg.

Russell Earl Stuart (1920-12.10.2008; Canada); Professor of Anesthesiology; served in the army during the WW II and the Korean War; received his M.D. degree in 1950, majoring in Anesthesiology (1955). In the period 1962-1964 he took part in the creation and the work of Medical Faculty at the University of Lagos (Nigeria); later worked at the Queen's University in Kingston, and from 1968 – at the University of Western Ontario (Canada). He also headed anesthesiology department at Victoria Hospital. His scientific and practical activity was devoted to the problems of pain and pain relief, an award-holder, an author of numerous publications.

Saltseva Maria T. (25.12.1924-22.10.2009) Doctor of Medical Sciences, Professor, Honored Doctor of the Russian Federation, Chair of Hospital Therapy of Gorky Medical Institute; from 1962 to 2000 was chief cardiologist of Gorky/Nizhny Novgorod Region; at the beginning of the 1980s took an active part in the development of the regional tele-ECG network.
Sausmarez Carey Lewis Stafford de (09.08.1925-10.11.2009) Professor, received his medical degree at the Queen's University, he worked as a radiologist in the USA. For about 20 years he headed the chair of diagnostic radiology and nuclear medicine at the University of Western Ontario and is one of the telemedicine pioneers in Canada.

Shklyarenko Mikhail P. (13.06.1936–06.2010; USSR-Ukraine), Head of the Poltava Regional Cardiological Dispensary, Honored Doctor of Ukraine, Emeritus Professor of the Ukrainian Medical Dental Academy. After the graduation from the Dnepropetrovsk Medical Institute in 1959, Mikhail Shklyarenko began working as a head of the local hospital. Subsequently, he was transferred to the post of the chief physician of a health resort; since 1960 he returned to the position of the head of the hospital, being at the same time the chairman of the expert examination of labor capacity at collective farmers, and was in charge of Continuing Education Courses for the district paramedics until 1970. In the period of 1970-1984 he headed the department of cardio-rheumatological specialization. From 1984 to 2009, Shklyarenko headed the Poltava Regional Clinical Cardiology Hospital and at the same time worked as a regional cardiologist. Under his leadership, in the mid-1980s an extensive tele-ECG network was arranged in the Poltava Region. M. P. Shklyarenko was awarded "For Excellence in Health Protection" badge, numerous diplomas of General Directorate of Health State Administration, the Distinction Badge of the President of Ukraine, the medal named after Academician M. D. Strazhesko, he was also a laureate of "Golden Fortune" rating, the award-winner of the All-Ukrainian project "Events and personalities of the twenty-first century."

Shurigin Dorofei Y. (18.06.1923-20.07.1982) Doctor of Medical Sciences, Professor, Major-General, a veteran of World War II, since 1947 worked at the Military Medical Academy, in the 1970s he carried out works in the field of design and construction of information and diagnostic systems for ECG automated analysis; author of 70 scientific papers and four manuals, was awarded 3 military orders and 12 medals.

Soule A. Bradley (1903-1983), Radiologist, received Doctor’s Degree in 1928; worked at the Medical Faculty of Vermont University for 54 years; founder of residency school, author of multiple scientific papers, awarded with medals and diplomas of many professional associations.

Stark Lawrence W. (21.02.1926-22.10.2004) Professor, a neurologist and engineer, he is famous for his works in the field of physiology of vision organ and physiological optics.

Sureau Claude (27.09.1927), Professor (1961), academician, obstetrician-gynecologist and physiologist, Doctor of Medicine since 1955, ran a number of departments and laboratories at several universities and hospitals in France, studied perinatal physiology, electrical activity of gravid uterus, developed recording technique of fetal EC and monitoring. He actively worked on problems related to biotics and was the author of numerous scientific works, public person, Chevalier of the Legion of Honor.
Tampas John P. - Professor of Radiology, received Doctor’s Degree in 1954; joined the University of Vermont in 1962 as an Assistant Professor where he got promoted to the Clinical Director; community leader, awarded with medals and diplomas of various professional associations.

Traeger Alfred Hermann (02.08.1895-31.08.1980; Australia), engineer, inventor "of the pedal radio". Since childhood, he was fond of radio, and made a home phone at the age of 12. He studied mechanical and electrical engineering at the South Australian School of Mines and Industries (associate diploma, 1915), worked for the Metropolitan Tramways Trust and the Postmaster-General's Department. During the First World War, he applied for admission into the army, but his application to join the Australian Flying Corps was refused because of his ethnic origin (his grandfather immigrated to Australia from Germany). About 1923 Traeger joined a private company in Adelaide, handling their car generator and electrical repairs; at the same time, apparently, he built his first pedal transmitter-receiver.” Shortly thereafter, Traeger established a company producing radios of his own design, which were successfully sold not only in Australia but also abroad (Nigeria, Canada). From 1928, together with John Flynn, he began work in Adelaide on a transceiver for the flying doctor network, constantly upgrading and improving the design of "pedal radio", which became a technical basis of the national telemedicine network. He was a member of the Institution of Radio Engineers, Australia.

Tsybulina Ekaterina V. (USSR), Candidate (1961) and Doctor (1970) of Medical Sciences, Professor, graduated from the Volgograd State Medical Institute (VSMI) in 1953. In 1972-1997 she headed the Department of Intermediate Level Therapy VSMI. She was the author of about 120 scientific papers. Medical and scientific and pedagogical experience of Tsybulina is more than 50 years. She made an invaluable contribution to the training of highly qualified scientific and pedagogical staff in the department and expanded the clinical base of the department. In the mid to late 1970s she took an active part in the development of telemetry system "Kovyl" and in the formulation of the indications for tele-ECG consultations.

Uhley Herman Noah (17.10.1926-01.02.2012; USA), MD., Scholar, teacher, innovative researcher, Professor Emeritus. At the age of 17, he enlisted the U.S. Navy, acquiring a special interest in research involving the development of radar. After demobilization he went to medical school at the University of Wisconsin in Madison, which he successfully finished in 1951 and began his doctor training at Michael Reese Hospital in Chicago. In 1956, he moved to San Francisco, where Dr. Uhley began a 50 year career as an internist specializing in cardiology at Mt. Zion Hospital. He was promoted from an internist to the chief physician. Throughout his medical career Uhley created many life-changing devices, including the development of a pacemaker in 1958, and in the 1970s ambulance-to-hospital EKG telemetry system. He was one of the founders of the system for providing urgent pre-hospital care, the inventor of numerous devices and intensive care methods for ambulances. He was the author of over 300 research-based publications in peer-reviewed medical journals.
Usichenko Ivan I. (born on 08.19.1938; USSR) was born in the Kyiv Region in the family of farmers, graduated with honors from the Cherkasy midwifery school and the Dnepropetrovsk Medical Institute. In 1963-1975 he headed the Krivoy Rog ambulance station. During the work the station became a school of excellence in Ukraine. Since 1975 he was the chief doctor of the Kiev ambulance station. He organized the implementation of tele-ECG at the Ambulance Service of Kiev. He was the Honored Doctor of Ukraine (1997), and was awarded the Order "For Merit" III Art. (1998). In addition, he was a Chairman of the National Committee of the Red Cross Society of Ukraine and President of the Ukrainian Red Cross Society (since 1986).

Utyamyshev Rustam I. (1926-1999) – Doctor of Engineering, Professor, and Academician of Russian Academy of Natural Sciences, for 17 years was a director of All-Union Scientific Research and Testing Institute of Medical technique of MH of the USSR. He was a foremost authority in the field of aviation, space and medical technology. Author of over 300 scientific works, 120 inventions created more than seventy items of cosmic medical equipment.

Velikovskaya Lyubov M. (USSR), Candidate of Medical Sciences (1974), Physician of Superior Merit. In 1951 she graduated from Gorky State Medical Institute, then during 59 years worked in the Municipal Hospital No.38, and headed the remote diagnostics centre. For more than 20 years she was a teaching assistant of Intermediate Level Therapy Department of Gorky State Medical Institute.

Vilyanskyy Mark P. (07.12.1924 -03.24. 1991; USSR), Candidate and Doctor of Medical Sciences, Professor, Honored Science Worker of the Russian Soviet Federative Socialist Republic, graduated from Moscow Medical Institute and was enrolled to postgraduate training program to the department of operative surgery and topographic anatomy. From 1949 to 1953 was an assistant Professor of the same department, combining the main job with clinical work in the hospitals of Chelyabinsk. Since 1953 he supervised the surgical department of the Municipal Hospital in Zhukovka, Moscow Region. In 1960-1965 Vilyanskyy headed the Chair of departmental surgery of Omsk Medical Institute, and was also a surgeon-in-chief of Omsk Public Health Administration. Between 1965 and 1968 he headed the department of surgery combining the post of Pro-rector for Research at the Tyumen Medical Institute. Starting from 1968 the life and work of Mark P. Vilyanskyy were connected with Yaroslav Medical Institute, where he headed the departments of general surgery, surgery of Doctors Improvement Faculty and departmental surgery. For many years he was the manager of group "Medical cybernetics" of the RF Ministry of Health. He was the author of 200 scientific works, including 12 monographs; was honored with Award for excellence in health protection and medals.

Vinogradova Tamara S. (USSR), Doctor of Medical Sciences, Professor, an employee of Moscow Regional Research Clinical Institute n.a. M. F. Vladimirskyy, an organizer and a chief of the department of functional Diagnostics (1963), where in 1974 a remote diagnostic centre was established. The latter became the basement of tele-ECG network in the localities near Moscow. Her scientific work is connected
with the development of objective assessment criteria for functioning of the blood circulatory system as well as for treatment control and disease state forecasting.

Vishnevsky Aleksandr A. (11(24).05.1906-19.11.1975; Russia), Doctor of Medical Sciences, Professor, Academician of Academy of Medical Sciences of the USSR, Colonel General; received his M.D. degree in 1929, gave lectures at the Kazan University and at the RKKA Military Medical Academy (1931-1933). Since 1939 he was a head of surgical department of All-Union Institute of Experimental Medicine; took part in military campaigns of 1939-1940 as an army surgeon and a surgeon-in-chief of Volkhovskiy, Karelian front line. Since 1948 worked as the Director of the Institute of Surgery n.a. A. V. Vishnevskyy, since 1956 as surgeon-in-chief of Soviet Army, too. He performed important research on anesthesiology, lungs, heart and vessels surgery, solved the problems concerning cybernetics, electronics application and the use of lasers and polymer substances in surgery. In 1953 he was the first in the world to conduct cardiac surgery with local anesthetic and in 1957 he performed first in the USSR open-heart operation with the application of domestic artificial blood-circulation apparatus.

Voynov Vasily I. ((born on 3.11.1929) - Honored Doctor of the RSFSR and Russia, Chief Doctor of Orenburg Regional Clinical Hospital No.1. In 1979 Regional tele-ECG RDC was opened under his supervision.

Weinstein Ronald S. (born in 1939, USA); Professor of Pathology; received his M.D. degree in 1965, completed his internship and residency at Massachusetts General Hospital and Harvard Medical School. He was the youngest M.D.- NIH funded researcher. Since 1975 he held the position of Professor of Pathology in a number of Medical Colleges. From 1990 to 2012 Weinstein was the Head of Pathology at the University of Arizona; an outstanding scientist and a public person.

Williams Horatio Burt (17.09.1877-01.11.1955, USA) was the first clinical electrophysiologist in America and perhaps its first biomedical engineer. He practiced medicine at Cornell University Medical School (until 1911), became an associate professor of physiology (1916-1922), professor and chairman of the Department of Physiology (1922-1942) at Columbia University; created ECG machine at Columbia University in 1912 after meeting with W. Einthoven. Williams improved on the string galvanometer to make it accessible to patients confined to a bed and performed innovative researches in physiology.

Wittson Cecil L. (14.01.1907-10.10.1989), Professor, founder and first Director of the Nebraska Psychiatric University (1950); in 1964-1968 was the Head of Medical College, in 1968-1972 – Chancellor of the University Medical College (Omaha, Nebraska). After retirement in 1972 obtained the title of the Honourable Chancellor and after that worked in the National Healthcare Institute for 3 more years.

Woolsey Frank M. (born in 1911; USA), Professor, one of the founders of the use of telecommunications in medical education, co-founder and the head (1959-1961) of Non-governmental organization "Council On Medical Television". He received his medical degree in 1938 from Duke University; after an internship and
residency he served in the army (1943-1946). In 1950 was appointed the head of the medical unit at the Veterans Affairs Hospital in Albany. Since 1951 he has been a member of the University of Albany Medical College and was promoted from an assistant professor to the Director of the Department of Postgraduate Education and the Chairman of the Committee on continuing education of physicians.

Yanushkevichyus Zigmās I. (3  16.10.1911-26.05.1984; Georgia-Lithuania/USSR), therapist, Doctor of Medical Sciences (1954), Academician of the Academy of Medical Sciences of the USSR (1967) and the Academy of Sciences of the Lithuanian SSR (1968). In 1927 he finished gymnasium, and in 1935 graduated from the Medical Faculty of the Vytautas Magnus University, worked as a doctor, a resident physician. In 1942-1944 was in military service. Then he worked as a teacher at the Kaunas Medical Institute and in 1953 became its rector and the head of the Hospital Therapy Department. His major works dealt with the diagnosis and treatment of cardiovascular diseases, medical cybernetics and organization of research work. He was awarded the USSR State Prize (1969) for the development of new methods of diagnosis and treatment of patients with myocardial infarction.

Yanushkevichyus was a deputy of the Supreme Soviet of the Lithuanian SSR of the 4-9 convocations, was awarded the Order of Lenin and four other orders. The Kaunas Research Institute of Physiology and Pathology of the cardiovascular system has been named after him. He was the author of over 450 scientific articles, the creator of his own cardiac school.

Yazdovskyy Vladimir I. (24.061913 - 17.12.1999; Russia), Candidate and Doctor of Medical Sciences, Professor, laureate of the State Prize of the USSR (1952), a member of the International Academy of Astronautics, an honorary member of the Academy of Cosmonautics n.a. K. E. Tsiolkovsky, medical colonel, founder and the first director of the research program on space biology and medicine. In the 1920s he received higher technical education in the city of Samarkand, worked in the system of water management, and later moved to Tashkent; in 1941 he graduated from the medical institute and prepared his thesis on neurosurgery. In November of the same year he was drafted into the army, served in the army during the Great Patriotic War as a chief medical officer of the 289th Assault Aviation Division. After the war, he was transferred to the Moscow Institute of Aviation Medicine of the USSR Ministry of Defense (1947-1964). At the Institute Yazdovskyy worked his way up from a researcher, head of laboratory, department and administration to the deputy chief of the Institute for Science (space biology and medicine). From 1964 to 1967 Vladimir I. Yazdovskyy worked at the Institute of Biomedical Problems as a head of a sector and deputy director for science; studied the problem of human life support in space flight (substantiation, design and use of medical monitoring systems for space flights). Later he worked at the All-Union Research Institute "Biotechnika" as a chief of the laboratory and as a chief research worker. He is the author of over 270 scientific papers, was awarded 6 orders and more than 30 medals for labour, military and scientific achievements; winner of the International Aeromedical Academy (Belgium) award. Under his supervision candidate and doctoral theses were defended. Yazdovskyy is the author of the famous monograph "On the trail of the Universe" on the contribution of space
biology and medicine to space exploration. Under the leadership of Yazdovskiy in the late 1940s and in the 1950s medical problems, developments of spacesuits and hermetic enclosures were studied, biological research of the upper atmosphere and outer space was carried out. The team, led by V. I. Yazdovskyy, was engaged in medical training of Yuri Gagarin and other cosmonauts of the First Squad.

**Yeager Charles Levant** (1907-1996); in 1935 started using EEG in Mayo Clinic. From 1947 till 1974 he was an employee and chief of EEG laboratory of The Langley Porter Psychiatric Institute, California, USA.

**Yemeshin Konstantin N.** (born on 19.06.1945; USSR), Candidate of Medical Sciences, an Assistant Professor, an Academician of International Informatics Academy. In 1962 he entered the Altai Medical Institute, after graduation performed postgraduate studies, then became a teaching assistant and finally vice-rector for education. In 1971-1978 Yemeshin arranged the courses on "Medical Cybernetics" and "Medical Biophysics" at a higher medical establishment; implemented the project on computerization of the Medical Institute. In 1980-1982 he was a co-developer of the All-Union and republic-wide conception of informational support. He implemented the quality management system of the regional medical aid. From 1984 till 2000 he was the Director of Altai Regional Medical Computer Information Centre and at the same time an assistant manager of regional health service department. Later on he headed a range of information analysis groups. Since 2006 he has been the chief of the Office for Patient Rights Protections of Autonomous Nonprofit Organization "Medicine and Law". Konstantin N. Yemeshin was a presidium member of a task group of the USSR Academy of Medical Sciences (the Russian Federation) "Medical Cybernetics", a chairman of the Academy of Medical Sciences of the Russian Federation for "Fundamental groundings of individual and public health", a public person and a political leader. He is the author of more than 130 scientific works, a member of more than 80 international conferences.

**Zvorykin Vladimir K.** (17(29).07.1889-29.07.1992; Russia) - an engineer, inventor of modern television, graduated with distinction from St. Petersburg Technical Institute, got the degree of engineering technologist. Zvorykin was a student of B. L. Rozing. For a year he studied at le Collège de France looking into X-ray diffraction, then moved to Germany to complete a course on Theoretical Physics at Charlottenburg Institute of Technology. During the World War I he was “under colour”, i.e. officers' radioschool; in 1917 he managed to establish the radio communication between the Taurida Palace and Kronstadt by the order of Interjacent Government. During the Civil War he moved to Siberia, where he joined the government of A. V. Kolchak. In 1919 he went on a business trip to New York. In the USA he was an employee of a range of the commercial companies, dealt with developments in the field of visual communication. By 1929 he had designed a high-vacuum receiving tube - a kinescope, developed numerous elements for electronic television facilities. The ground-breaking invention was the creation of transmitting electron-beam tube with charge accumulation and high photo-response, which was patented in 1931. In 1933 the television system with expanding up to 240 lines was made, in 1934 – the expansion reached 343 lines with video interlace. In 1936 in the
USA television shows using this system were appeared, and since 1938 the production of cable boxes on the basis of Zvorykin's system started in the USSR. In the second half of the 1930s Zvorykin studied the problems of electronic optics, developed electron microscope together with James Hillier. During the World War II night-vision devices designed by Zvorykin were used in the US army to equip tanks and motor vehicles, and also as a scope. In 1954 he resigned the headship of the electronic laboratory of RCA Company, started to carry on active managerial and scientific work, founded a range of societies in the field of television and radio electronics, including in the spheres of medicine and biology. He is the author of more than 80 scientific works and 120 invention patents. He was awarded 30 different grades, including the U.S. National Science medal and French Order of the Legion of Honour.

* USSR (Union of Soviet Socialist Republics) and Russia are used as synonyms in the text.