

90 years of the Ural State Medical University: development of scientific activity

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Abstract

Since the foundation of the Ural State Medical University (USMU), the importance of scientific activity in the training of specialists with higher medical education has been determined. A contribution to the history of medical science in the Urals since the 30s of the twentieth century was made by those who began work at the Sverdlovsk State Medical Institute, whose discoveries made it possible to find new methods of diagnosis and treatment, to identify the causes of any disease. For 90 years, the results of the activities of representatives of the established scientific directions and schools of Ural State Medical University have been used in the educational process and healthcare. The article describes the promotion of scientific activity of Ural State Medical University and its productivity over the previous decade. We analyzed reports on research activities for 2010–2020, materials based on the results of monitoring the effectiveness of Ural State Medical University, scientometric databases “Russian Science Citation Index” (RSCI), Web of Science, Scopus. Along with the development of traditional medical research areas and schools, the university researches in the areas of scientific medical platforms, cooperates with leading scientific, educational and medical organizations. The development of personalized medicine, digital medicine, reconstructive medicine, as well as the use of cellular technologies, and the fight against infectious diseases are highlighted among the topical areas. Over the current decade, the number of publications indexed in international abstract databases has increased 4 times in Scopus, 2 times in Web of Science, and 2.6 times in RSCI. The total number of citations of articles over five years (2016–2020) in Scopus was 990, Web of Science — 766. The number of articles included in the list of the Higher Attestation Commission under the Ministry of education and science of the Russian Federation, for a number of years on average — 456. There is the dynamic development of the scientific activity of Ural State Medical University with a focus on cooperation with leading research teams of other organizations, the implementation of research on a state assignment, accompanied by a significant increase in publication activity.

Keywords: development of scientific activity, university science, scientific research, publication activity, Ural state medical university.

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The success of the scientific activity of a higher institute of learning significantly influences the quality and attractiveness of the educational programs it implements, creates a healthy atmosphere of competition with academic science, and acts as a factor in its competitiveness with other universities globally. Supporting the development of science in universities is one of the priorities of the modern science and technology policy in Russia. Earlier, scientific activity in higher education was of a secondary nature in comparison with educational activity, which was reflected both in the personnel potential and in the structure of expenses of the educational organization; however, in the current decade, the positioning of university science as a plat-

form for training researchers for industry, corporate, and academic science is in high demand [1–3].

The research activities of the university are relevant in the scientific-theoretical, methodological, practical, and social aspects. The interaction of scientific and innovative experience, educational process and healthcare practice, implemented at the Ural State Medical University (USMU), ensures the implementation of research in major fields of science. All this determines the recognition of the fact that USMU serves as a center of medical science, and its strides and achievements have an impact on the up-to-date development of the region. Thus, according to the RAEX rating agency (RA Expert), the university is included in the

100 best educational institutions of higher education in Russia¹.

Organization and modernization of university research activities are focused on the Strategy for the development of medical science in the Russian Federation spanning through to 2025², the Strategy for the scientific and technological development of the Russian Federation³, and the aims and objectives of the national projects “Science,” “Education,” “Health” [4, 5]. The significance and relevance of research is confirmed by publications in scientific rating journals and monographs. At the same time, the citation of published materials testifies to their assessment by the professional community.

We aimed at demonstrating the tendency in the development of scientific activity of USMU over the previous decade.

We obtained data from annual reports on research activities from 2010 to 2020, as well as information and analytical materials based on the results of the USMU performance monitoring, and scientometric data on the bases of the Russian Science Citation Index (RSCI), Web of Science, and Scopus.

Traditionally, at the university, the leading role in conducting scientific research belongs to the USMU departments, and the central research laboratory. At the same time, cooperation with major scientific, educational, and medical organizations is developing in research using various organizational forms of interaction (such as consortia and joint research teams).

During the evolution of USMU from an institute to a university (1930–2013), medical scientific directions and schools were formed, thereby making a significant contribution to the development of medicine, and gaining fame in the scientific world [6–10]. These include the Ural schools of pediatricians, pathophysiologists, surgeons, anesthesiologists-resuscitators, traumatologists, cardiologists, neurologists and neurosurgeons, hygienists, ophthalmologists, obstetricians-gynecologists, pharmacologists, dentists among others.

The results of the activities of representatives of scientific schools and directions are being introduced into health care: teaching students, residents, graduate students, and doctors [6–10]. Moreover, training of personnel of higher scientific and pedagogical qualifications in postgraduate and doctoral

studies is of great importance. Postgraduate studies in USMU involve five fields: biological sciences, fundamental medicine, clinical medicine, preventive medicine, and pharmaceutical sciences.

USMU has five dissertation councils on 11 scientific specialties, namely Anesthesiology and resuscitation, Surgery, Nervous diseases, Cardiology, Internal medicine, Pediatrics, Dentistry, Pathophysiology, Obstetrics and gynecology, Hygiene, and Occupational medicine. From 2010 to 2020, 379 theses were defended by employees of the university and other organizations, including 57 for the degree of PhD in Medicine.

Dissertation research at USMU is performed on topical problems of modern medicine, not only enriching the area of theoretical knowledge, but also solving pertinent issues of health care. This is reflected in the fields and subjects of research, and is confirmed by the theses defended (142 for the specified period) in a number of specialties (physiology, organization of pharmacy, traumatology and orthopedics, public health and health care, skin and venereal diseases, eye diseases, pediatric surgery among others) in dissertation councils of other organizations.

Implementing research in the areas of scientific medical platforms is an important element to strategically develop of university science. Since 2015, the university has been conducting applied research and development works at the expense of budgetary funding (state task approved by the Ministry of Health of Russia).

From 2015 to 2020, 23 themes were defended on scientific platforms involving Immunology, Innovative fundamental technologies in medicine, Oncology, Invasive technologies, Regenerative medicine, Cardiology, and Angiology. According to the results of these studies, 220 articles were published, including 128 in journals with an impact factor of more than 0.3 (85 in rating Russian journals, 43 in International journals).

So, 14 of these research projects performed on a state order were completed in 2020, and each of them was performed for 3 years. As a result of the work “Immunoregulation and immune monitoring of the reactions of damage and restoration of tissues of the oral cavity,” an experimental model for periodontitis was created, thereby permitting the evaluation of systemic and local reactions of the body in chronic periodontitis. This model can be used in the development of new methods of dental treatment. It is used in the USMU central research laboratory for the development of new treatment-and-prophylactic and diagnostic methods. In patients with periodontal disease, the clinical value of 40 laboratory parameters was first established

¹ <https://raex-rr.com/database/contender/10000230>

² Order of the Government of the Russian Federation of December 28, 2012 No. 2580.

³ Decree of the President of the Russian Federation of December 01, 2016 No. 642.

and ranked, and a provision on laboratory monitoring of patients was formulated [11].

A project aimed at the development and creation of computer technology for the quantitative assessment of hemodynamics in the coronary arteries by the rate of diffusion of a contrast agent in the diagnosis and treatment of patients with chronic forms of coronary heart disease has been conducted. Based on video images of standard angiographic examination of patients, algorithms and original software were developed to obtain detailed information about blood flow in coronary arteries with stenosis [12]. This approach will be used in the treatment of patients with chronic forms of coronary heart disease.

In the study "Use of remote monitoring of the patient's condition, modern methods of machine learning, and personalized modeling to increase the effectiveness of electrocardiotherapy in patients with chronic heart failure (CHF) and after orthotopic heart transplantation," the characteristics of the functional geometry of the left ventricle in patients with cardiosynchronous implants were obtained for the first time.

The proposed model for controlling acute and chronic heart rejection in patients after heart transplantation led to the correct classification of progressive CHF in 93% of cases at different times after heart transplantation. It can be an additional evaluative factor of acute rejection or progression of CHF and detection of deterioration in the allograft condition [13].

In addition, within the framework of the 2020 state assignment, the works were performed, namely, "Technology for the treatment of articular surface injuries by implantation of autologous tissue-engineered structures," "Genetic engineering drug for the treatment of coronary insufficiency," "Study of the effect of expression of genes of the Klotho family on the rate of proliferation of malignant neoplasms," "Development of approaches for creating a bioartificial liver for the treatment of its dysfunction," "Engineering of cartilage tissue implants based on a new class of nanocomposite hydrogels: a development and experimental substantiation," "Improvement of surgical treatment of unstable injuries and post-traumatic deformities of the pelvic ring and post-traumatic and degenerative-dystrophic spine deformities," "Reconstructive revision and oncological endoprosthetics of large joints with the use of new personalized components and augments for filling bone defects, made from titanium using additive technologies (3D printing)," "New technologies for surgical treatment of post-resection, post-traumatic non-unions, defects and deformities of the limb bones based on addi-

tive prototyping with directional nanostructuring of the implant surface," "Development of bone substitute materials with tissue-equivalent properties to replace bone defects in cancer and trauma patients," "Technology of personalized determination of tumor sensitivity to neoadjuvant chemotherapy of molecular genetic subtypes of breast cancer using cell cultures," and "Predictors of an unfavorable prognosis of non-small cell lung cancer in combined tumor and dust lesions of the respiratory system and their pathomorphological diagnostics based on surgical and biopsy material." For 2021, the university received a new state task for the implementation of applied scientific research on nine subjects.

From 2010 to 2020, the number of articles in scientific journals indexed in international abstract databases increased, namely in Scopus, from 27 (for the period 2010–2015) to 113 (for 2016–2020) articles per year, and in Web of Science, from 42 to 83 articles, respectively. In the national bibliographic database of scientific citations, the number of publications of scientists and teachers of USMU = increased by a factor of 2.6 since 2010 and amounted to 1770 in 2020. Presently, the annual number of articles included in the list of the Higher Attestation Commission (HAC BAK) for the same period averages 456.

Currently, the priority fields corresponding to the scientific platforms of medical science are the development of methods for effective prevention of oncological, cardiovascular and other diseases, the introduction of personalized medicine, the use of cellular technologies, the development of digital medicine, and the combat against infectious diseases. Thus, trials are being conducted to study the efficiency of multipotent mesenchymal stromal cells; methods of medical rehabilitation using elements of telemedicine (telerehabilitation) are being developed for patients with consequences of intensive care and acute respiratory distress in adults [14–16].

In connection with the spread of the new coronavirus infection (COVID-19), the need for research and development were initiated and has been on the rise since 2020. In 2021, the USMU scientists, together with researchers from the Ural Federal University, received a grant from the Russian Foundation for Basic Research and the China National Natural Science Foundation to study promising drug candidates for a number of azolazines and other small molecules in relation to SARS-CoV-2 (and other viral infections).

USMU continues its cooperation with the Ural Scientific and Educational Consortium of Biomedicine, Pharmacy, and Medical Engineering. Works are performed to analyze bioequivalent materials

for dentistry and reconstructive maxillofacial surgery, as well as research on the use of better approaches in traumatology and orthopedics, study of biological tissue regeneration when replacing bone and cartilage defects with new promising ceramic materials and composite matrices, and computer models and programs for the diagnosis of heart diseases are under development.

In 2020, USMU entered the Ural interregional scientific and educational global-level center “Advanced production technologies and materials” (UISEC). Within the UISEC, the university is involved in the development for regenerative and substitution medicine, products based on tissue-engineered structures obtained using stem cells and composites from biodegradable materials for traumatology, surgery, dentistry, and oncology.

One of the main fields of modern medicine is clinical and research work on the development of a geriatric approach in health care. In order to expand cooperation with major research teams for the development of this direction, USMU is intended to become a member of the Russian National Consortium for the Study of Aging. Thus, the university conducts research on the selection of individual combination geroprophylactic therapy, the study of aging predictors in the oral cavity, and the identification of biomarkers of gerodiagnostics in humans.

The development of scientific and educational communications, the creation of an environment for an open exchange of information and knowledge is facilitated by the publishing potential of the university. USMU is the founder of the scientific journals *Ural'skiy meditsinskiy zhurnal*, *Problemy stomatologii*, *Vestnik Ural'skoy meditsinskoy akademicheskoy nauki*, which are included in the list of journals recommended by the Higher Attestation Commission. In addition, the *Vestnik Ural'skogo gosudarstvennogo meditsinskogo universiteta* is published, indexed in the RSCI. More than 25 monographs and collections of articles based on conference proceedings are published annually. Researchers and teaching staff of the university are co-authors of clinical guidelines, national and federal manuals, and textbooks. The professor at the Department of Physical and Rehabilitation Medicine of USMU is included in the author's team of temporary guidelines for the prevention, diagnosis, and treatment of a new coronavirus infection (COVID-19) of the Ministry of Health in Russia.

The recognition of the achievements of USMU by the scientific and medical community is evidenced by the victories of scientific and pedagogical workers, undergraduate students and young scientists in regional and federal professional competitions. These are contests for the V.N. Tatish-

chev and G.V. de Gennin prize, the Governor of the Sverdlovsk Region prize for young scientists in the nomination “For the best work in the field of medicine,” “Minute of Techno-glory,” “Relay of University Science,” All-Russian STARTUP-TOUR, Prize “Prizvanie,” P.P. Polzunov prize, and awarding the Order of Friendship. The Prize of the Government of the Russian Federation in the field of science and technology for the development and implementation of high-tech minimally invasive surgeries in abdominal surgery and oncology was awarded in 2018 to the Head of the Department of Surgery, Coloproctology, and Endoscopy of USMU.

Thus, USMU participates actively in the development of medical science. By its 90th anniversary, scientific cooperation with the major research teams of the country has expanded, scientific research and development is performed annually within the state assignment, and the publication activity of scientific and teaching personnel are on their rise.

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