HIGH TECHNOLOGY AND HEALTH CARE IN RUSSIA

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Summary

Examples of application of high technologies for human health care in Russia are considered in this article. It discusses achievements in information technologies, lasers, ultrasound, stable and radioactive isotopes, sorption and membrane techniques for prophylactics, diagnostics and treatment of diseases. Examples of the creation and the application of artificial organs and tissues are included in the article. The utilization of achievements in biotechnology and immuno-biotechnology, for the creation and production of medicines, vaccines and diagnostics are described.

1. Introduction

One of the main human needs is the need for high quality medical service. Achievements in modern medicine have helped to improve human life expectancy, reduce mortality level, increase quality of life for the elderly, and prevent epidemics of dangerous diseases.

Achievements in human health care are closely related to the level of scientific and technological development of a country. Many examples of this can be observed in Russia. Modern medicine requires up-to-date means of information receipt and analysis. High technologies are necessary for production of up-to-date diagnostic equipment and modern medical instruments. The medical laser is an example of a device based on high

technologies. The development of chemical technology promotes the creation of such medical procedures as purification of blood and other biological liquids by means of sorption. High technologies are essential for creation and extensive utilization of artificial organs and tissues.

Modern medicine needs highly purified substances, the required level of purification cannot be reached without contemporary chemical technology. The elaboration and the production of modern drugs, vaccines and means of diagnostics are also connected with the development of technology, especially with the progress in biotechnology and immuno-biotechnology. Modern diagnostic techniques, such as computer tomography, are based on achievements in the field of production and isolation of radioactive isotopes.

High technologies are being developed in Russia in certain specialized medical centers. Examples of scientific and medical centers, which possess equipment and techniques conforming to the world standard, are the Research Institute of Physical Chemical Medicine, Institute of Biomedical Chemistry, the Central Institute of Traumatology and Orthopaedics named after N.N. Priorov (CITO), N.N. Burdenko Neurosurgical Institute, N.V. Sklifosovsky Institute for Emergency Medicine, A.N. Bakulev Institute of Cardiovascular Surgery, Intersectional Research and Technology Complex "Eye Microsurgery", Cardiology Research Center, and the Institute of Transplantology and Artificial Organs.

Contemporary achievements in human health care are based on successes in physics, chemistry, biology and technology achieved by soviet scientists in the preceding decades. For example, the development of isotope techniques in diagnostics and treatment is connected with achievements in nuclear physics and physical-chemical methods of separation.

So, the level of application of high technology in Russian medicine is determined, on one hand, by the high level of science, technology and education in the past, and on the other by the creative absorption of the best achievements of global science and technology.

The Russian government gives the proper attention to the development of high technologies in different fields, including medicine. The Ministry of Health Care of Russia has elaborated the programs devoted to medical high technologies. These programs were aimed at creation and extensive application of modern techniques for human health care. Examples of high technology applications for human health care in Russia are presented below.

2. Information technologies

It is impossible to imagine modern medicine without computers and computer technologies. Computers and the appropriate software are necessary for the analysis and presentation of data in a form suitable for doctor and patient. Wide application of complex diagnostic procedures, such as computer tomography, would be impossible without up-to-date means of information analysis. Computers can control the work of

medical equipment, e.g. the function of artificial organs.

Use of the global computer network gives the opportunity to search for and exchange medical information. "Internet" technology allows any medical center or hospital to use donor organs and tissues from all the word. "Internet" allows doctors located thousands of kilometers from a patient to carry out medical consultations and to follow operations "on line".

Progress in the information technologies, including medical ones, is related to development both in the field of proper computer technology—increase of processor speed, expansion of memory volume, program creation, etc.—and in the field of communication technology, e.g. elaboration and use of new satellite systems, optical cables, etc.

3. Lasers in medicine

During the period of their existence lasers have found application in all branches of science and industry, including medicine. Lasers possess a broad range of action—they are used in surgery, therapy and diagnostics. The laser radiation acts both at the level of the whole organism, its systems and organs, and at the level of tissues and cells. Various types of lasers, which can irradiate light with different wave lengths, are applied to medical practice: ruby, carbon dioxide and helium-neon lasers, copper vapor based laser, erbium laser, etc.

In medical practice, depending on the aim, laser light with different characteristics can be applied. The radiation can be of high or low intensity, and with various wave lengths and diameter of the beam. A sharply focused beam with high intensity of radiation is used as a surgical instrument. Such a beam is able to cut a tissue without bleeding, because blood instantly coagulates on contact with the laser light. A lot of surgical operations, particularly in microsurgery, are carried out by means of laser. It is possible to remove the affected areas of dental tissue by means of laser ray of high intensity, so laser techniques are widely used in stomatology.

Laser light of high intensity, and large diameter beam, enables the removal of a thin layer of affected tissue. This peculiarity of the laser action is widely used in the treatment of festering wounds and burns, and also in cosmetics and dermatology. Laser evaporation is the modern technique of removal of surface skin defects such as warts, scars, tattoo, birthmarks, etc. Laser action on a large area of skin with the aim of rejuvenating it is becoming popular.

Laser radiation of low intensity is applied for therapy. The laser light is used for the treatment of inflammatory processes. A new application is the use of low intensive laser light for oncology. The application of such radiation gives good results at all stages of cancer treatment. Laser therapy is used for the preparation of a patient before a major operation, for the treatment of complications during the early post-operation period, for prophylactics of acute complications after electron and neutron therapy, and for the rehabilitation.

We can expect that the field of laser applications in medicine will extend, as lasers of new types and designs will become involved in medical practice, and the price of laser therapy should decrease.

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Biographical Sketches

Yurtov Eugeny Vasil'evich was born in July 1947 in Moscow, Russia. He graduated from the Physical Chemistry Department of Mendeleev Institute of Chemical Technology (now Mendeleev University of Chemical Technology of Russia) in 1971. He was granted a Ph.D. in Chemistry in 1975 and Doctor of Science in 1991. He has worked in the Mendeleyev University as Assistant Professor, Associate Professor and Professor. At present he works in the Industrial Ecology Department of Mendeleyev University.

He studies heterogeneous systems with biological media (blood, plasma, skin, etc.). He investigated extraction processes from biological liquids, especially, liquid membrane extraction in multiple emulsions. His works, concerning prophylactic and protective creams are well known, and such creams are used in dermatology. In Mendeleev University he gives a course of lectures in Chemical Toxicology. E.V. Yurtov is the author of about 200 scientific publications. He was elected Corresponding member of the Russian Academy of Sciences in 2000.

Nataliya Murashova was born in 1973. She graduated from D. Mendeleyev University of Chemical Technology of Russia (Ecology Department) in 1996. In the period 1996 to 1999 she was a post-graduate student of the Industrial Ecology Department of the Mendeleyev University. She carried out her thesis work under E.V. Yurtov's supervision. N.M. Murashova was granted a Ph.D. in Chemistry by the Thesis

Committee of D. Mendeleev University of Chemical Technology in June 2000. Her scientific work is concerned with investigation of structurization of surfactants in liquid systems. At present she works as Assistant Professor in the Industrial Ecology Department of Mendeleyev University.