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DEVELOPMENT OF THE INTERNATIONAL MEDICAL RESEARCH CENTER ON THE ESTIMATION OF THE STATE OF HUMAN HEALTH AND ITS REJUVENATION

The level of development of medical industry determines, in particular, the level of social development of the country. In addition, medical engineering and medical products are among the most knowledge-intensive industries. The level of technology used in the medical industry is comparable to that of military technology and is often the result of their conversion for civilian use. In this regard, it is impossible to overestimate the importance of the development of the medical industry for the successful realization of the scientific and innovation potential of China and Ukraine. Increasing the duration and quality of life of the citizens of China and European states is a state priority. The decision of these tasks contributes to the growth of the economy, as well as the reduction of treatment costs and social payments. However, this requires the availability of modern high-quality medical equipment and medical products. At present, in connection with the catastrophic increase in the number of antibiotic-resistant strains of pathogenic bacteria, the growing allergization of the population, it is relevant to search for alternative non-medicament methods for the prevention and treatment of the most common human diseases, as well as medical rehabilitation after severe illnesses.

Keywords: photonic systems, medical engineering, biomedical devices, diagnostics.

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РОЗВИТОК МІЖНАРОДНОГО МЕДИЧНОГО ДОСЛІДНИЦЬКОГО ЦЕНТРУ ОЦІНКИ СТАНУ ЗДОРОВ'Я ТА РОЗВИТКУ ЛЮДИНИ

Анотація: Рівень розвитку медичної галузі визначає, зокрема, рівень соціального розвитку країни. Медична інженерія та лікарські препарати є одними з найбільш інформаційних галузей. Рівень техніки, що використовується в медичній промисловості, можна порівняти з військовою технікою, і це часто є результатом їх перетворення для цивільного використання. У зв'язку з цим неможливо переоцінити важливість розвитку медичної галузі для успішної реалізації науково-інноваційного потенціалу Китаю та України. Підвищення тривалості та якості життя громадян Китаю та європейських держав є пріоритетним завданням держав. Рішення цих завдань сприяє зростанню економіки, а також зменшенню вартості лікування та соціальних виплат. Однак це вимагає наявності сучасного високоякісного медичного обладнання та лікарських засобів. Наукова проблема, яка повинна бути вирішена, полягає у створенні нового класу оптоелектронних приладів, що діагностують периферичний кровотік та інтелектуальні фотонні системи, що підвищить надійність діагностики порівняно з традиційними методами діагностики (реоплетизмографічні, ультразвукові тощо), а також функціональністю біомедичних пристроїв та систем швидкої діагностики периферичного кровообігу.

Ключові слова: фотонні системи, медична інженерія, біомедичні пристрої, діагностика.

Introduction

From the point of view of ensuring a decent standard of living for the citizens of China and Ukraine, the medical industry is one of the key, creating the opportunity to provide quality medical care. The level of development of this industry determines, including, the level of social development of the country.

In addition, medical engineering and medical products are among the most knowledge-intensive industries. The level of technology used in the medical industry is comparable to that of military technology and is often the result of their conversion for civilian use. In this regard, it is impossible to overestimate the importance of the development of the medical industry for the successful realization of the scientific and innovative potential of the China and Ukraine.

Increasing the duration and quality of life of the citizens of China and European states is a priority task of the states. The decision of these tasks contributes to the growth of the economy, as well as the reduction of the cost of treatment and social payments. However, this requires the availability of modern high-quality medical equipment and medical products.

The production of medical equipment and medical supplies is connected with the issues of ensuring national security - the basic level of medical care and the need for medical disasters should be provided primarily through own production.

Appointment of the Strategy

- to determine the priority directions of development of the MRC and the methods of their implementation;
- lay the foundations of public-private partnership;
- give impetus to the intensive development of technological biomedical developments, production and market introduction of innovative Chinese-Ukrainian-Poland products;
- Implement a new type of training system for biomedical engineering.

The main directions of the development of the Strategy:

- Estimation of the current state and identification of the main systemic problems of the development of biomedical engineering of the Research and Development Center.
- Definition of key approaches to overcoming systemic problems, determination of tasks of strategic development of biomedical engineering.
- Determining the role of state support in solving strategic tasks of biomedical engineering development
- Identify key activities aimed at the successful implementation of the Strategy, including a set of state measures to support the development of biomedical technologies.

The strategy is based on the following priorities:

- Implementation of an innovative model for the development of biomedical engineering, which includes the creation of high-tech industries, a research base that leads to the growth of the market of medical equipment and medical devices;
- Increasing the export potential of biomedical engineering products;
- Priority of Chinese, Ukrainian and Polish medical equipment and medical products in the implementation of state programs for the modernization of health care;
- Development of partnership with the world's largest leaders in the development and production of medical equipment and medical products, involving specialized technical specialists to intensify the development of advanced technologies;
- Localization in the territory of China, Ukraine, Poland of high-technology production of equipment, components, raw materials, materials for medical equipment and medical products.

Background of International Medical Research Center on the Estimation of the State of Human Health and its Rejuvenation

At present, in connection with the catastrophic increase in the number of antibiotic-resistant strains of pathogenic bacteria, growing allergization of the population, it is relevant to search for alternative non-medicament methods for the prevention and treatment of the most common human diseases, as well as medical rehabilitation after severe illnesses.

The complex ecological situation, urbanization, frequent stresses, lack of exercise and a number of other factors that negatively affect people's health have led to the fact that today not only the adult, but also the majority of children are in the polymorbid state, i.e. have more than two pathological processes in the body.The use of intensive medication in this situation (especially antibiotic therapy) will only exacerbate the situation, finally destroying the adaptive capabilities of the body.

Today a significant number of leading companies engaged in development and production of diagnostic medical equipment. The most famous ones are: Philips, MEDIC (Medizinische Messtechnik GmbH), Nonin, Cas Medical System, Radiometer, Micromed, Criticare, UTAS (Ukraine) and others. For biomedical devices is not the most important characteristics are painless, noninvasive measurements in the diagnosis. Among the methods that can provide it, occupy a prominent place optical. Optical methods inherent advantages such as noninvasive of diagnostics, optical signal indifference to electromagnetic interference, multi potential. They can accurately determine the quantitative and qualitative indicators of biological objects.

The scientific problem to be solved is to create a new class of optoelectronic devices diagnosing peripheral blood flow and intelligent photonic systems that will increase the reliability of diagnosis compared with conventional methods of diagnosis (reopletyzmographic, ultrasonic etc.) as well as the functionality of biomedical devices and systems in rapid diagnostics of peripheral circulation.

Photoplethysmography technique compared with other diagnostic methods for biological object, such as the photoacoustic method to increase the reliability of registration hemodynamic circulation, and the introduction of fiber elements technology and sources of different wavelengths of radiation allows the probe accurately solve problems photodynamic studies remote measurements of hemodynamic parameters or other biological object.

In this respect, promising work to create optoelectronic systems for diagnosis, therapy and prediction of the cardiovascular system as an effective universal means of rapid diagnosis of peripheral circulation, allowing for a long time to carry out monitoring of peripheral vascular publish current and averaged diagnosis-information on the physiological state.

Detailed description

I. In the pathogenesis of the absolute majority of clinical diseases present specific first phase - a violation of blood circulation. Therefore, treatment in a disease should be based primarily on the restoration of blood circulation in the body. Therefore, finding, development and improvement of technologies normalization of blood circulation in the human body and peripheral blood evaluation methods have always been, are and will be important task for developers of new medical equipment.

Among the known factors that are used to improve blood circulation, the most effective, completely safe and natural for humans is electromagnetic radiation in the optical range of the spectrum (light) and constant magnetic field.

Study of effect of these factors on blood circulation and development of technologies and related devices, and monitoring of human health is impossible without diagnosis or evaluation of peripheral blood circulation in the body. The most advanced methods nowadays considered optoelectronic conversion methods of registration and biometric information.

By non-invasive optical methods for diagnosing peripheral circulation refers PPG method to increase the reliability of the control of blood circulation in the diagnosis of early stages of the most common human diseases.

Significant advances in the pharmacotherapy of recent decades could not solve the problem of effective treatment of certain diseases. Moreover, there was a group of diseases and pathological conditions associated with the use of modern medicines. The number of diseases resistant to treatment. In some cases, treatment is aimed at combating the effects of disease, not its cause. This path can not be considered promising.

Therefore, it remains questionable finding and developing non-drug treatment and prevention of the most common human diseases, aimed at addressing the root causes of these pathologies. As such the primary cause in most cases is a violation of blood circulation in the human body, the question of the development of technologies and methods of restoring blood circulation its assessment remain in the zone of maximum attention of scientists, doctors and engineers.

Object is a state of blood circulation of the human body, which certifies that the prerequisites of the disease or its existence, and dynamic processes of interaction and transformation of optical radiation in biological tissue that occur in the registration and diagnosis of peripheral microcirculation.

The urgency of restoring impaired blood circulation is determined that it applies to almost every person because photonic peripheral blood recovery technology and non-invasive methods of evaluation, of course, provide maximum market needs.

II. Electrotherapy is a field of physiotherapy, using for therapeutic purposes electric energy out-of-the-way through special electronic equipment. Modern forms of electrotherapy use dosing the effect on the human body of various electrical signals, but primarily electric currents, electric and magnetic fields or electromagnetic fields. The effects of individual electrotherapy methods depend on the kind of electrical stimulation applied and its parameters. Known applications for the excitation of nerves, muscles, pain reduction, mitigation of inflammation, increased tissue poisoning, intensification of metabolism or acceleration of tissue regeneration. Electrotherapy is also used in ion-phoresis. Using devices for electrotherapy, you can also carry out the diagnosis of the neuromuscular system, which allows for a quantitative assessment of the functioning of the muscles.

III. Two stages of the algorithm are presented instantaneous evaluation of tremor parameters in the retime. At the first stage, the algorithm divides tremor and accompanying arbitrary movements that based on their different distributions in the frequency region. Further, estimates of the arbitrary motion of the from the aggregate of kinematic data, for the purposes of obtaining a tremor assessment. This assessment is then to the second stage, to the weighted Fourier transform, for estimating the tremor frequency, and for the Kalman filter, which uses the frequencies obtained to estimate amplitude of tremor. As a result of the algorithm

A high accuracy of the amplitude estimation and tremor frequency. The two-stage algorithm was tested on tremograms of patients suffering from pathology-states that cause tremors during performance of clinical and functional tasks. This algorithm can be used in automatic neuropsychodiagnostic systems, as well as in microsurgical robotics for compensation tremor of the hands of the surgeon during the operations.

The tasks to be performed in the frame of the project:

- establish the cooperation between the research groups in China, Ukraine, Poland University to gain research potential, transfer the knowledge and initiate the development of advanced biophotonic technique;
- develop measurement protocols and preliminary hardware, perform physiological measurements to explore patterns of interaction of low-intensity non-monochromatic electromagnetic radiation in different frequency range of the optical spectrum to the blood microcirculation system in the area of exposure and in remote areas of the human body;
- develop, create and validate hardware prototype for normalizing blood flow circulation using low-field non-monochromatic radiation for healthy people and patients with the most common diseases;
- develop photoplethysmography based contact-manner measurement technique for evaluation of physiological state of the microcirculation in the area subjected to the low-intensity non-monochromatic electromagnetic radiation.
- perform physiological measurements in laboratory conditions on healthy persons involving the low-intensity non-monochromatic electromagnetic radiation interaction and photoplethysmographic technique for blood perfusion assessment;

- develop a corrective model of distribution of optical radiation in biological objects with a comprehensive view of the effects of dispersion and uniform optoelectronic safety systems designed for research and rapid diagnostics of peripheral vessels;
- develop new algorithms and methods of registration scattered optical radiation, processing and identification of key hemodynamic parameters of peripheral circulation;
- create a new class of problem-oriented intelligent photonic technologies of diagnostics, treatment and storage of information to form a diagnosis, and practically apply basic results in medical practice (vertebrology, maxillofacial surgery, vascular disorders in diseases with systemic lupus, fibromyalgia, surgery of the anterior abdominal wall);
- reflect the obtained results and innovations in scientific publication or in international scientific conference in field biophotonics
- prepare national or European-China Union research program project proposal for the further investigation of light-tissue interaction and early detection of microcirculation alterations.
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Conclusion

Main research areas in creation biomedical technologies for diagnosis and treatment

- Development of optoelectronic systems of diagnosis of peripheral blood supply
- Development of two-dimensional systems multiparameter Mueller-matrix polarimetry for optical diagnostics-multilayer anisotropic structure of biological tissues
- Development of optoelectronic information - measuring systems for non-invasive diagnostics of biological tissues
- Development of laser devices for physiological effects
- The development of tomographic methods and implementation of optoelectronic systems of microcirculation research and conjunctiva of the eye fundus
- Methods of processing of biomedical images and signals

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