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SECTION 5. Innovative technologies in science.

REVIEW ON INNOVATIONS IN ROBOTIC SURGERY IN THE 21st CENTURY

Abstract: *The article examines the most recent and remarkable innovation in robotics. The role of robot is examined through the history and stated its importance nowadays in medical field. Also a new breakthrough experience in Russia has been described.*

Key words: *innovations, robot, medicine, doctors, artificial intelligence, science, surgery*

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Introduction

Social life has changed much over the last centuries and the process of modernization affects every person by improving quality of life. The 20th century is famous for its many discoveries and innovations. Due to numerous breakthroughs, many people believe that all possible discoveries remained in the past because with a fair degree of confidence we have everything to live. The average citizen lives more comfortably now than earlier. Another improvement is that the chance of sudden death is greatly reduced; social evils such as poverty, inequality, ignorance and oppression have been abated [1]. Nevertheless, each year we gain new accelerating advances that challenge us. Almost weekly we read stories from cancer sufferers, developments in the laboratories that might lead to new ways of treatment, we keep talking about space tourism and jet planes that would take us to fly around the world. They also seem so breathtaking and so unreal simultaneously that might seem like speculation or just simple fantasy.

In the 21st century, many fields of science have been developed. For instance, the first robot appeared in 1927. However, the idea of the robot originated much earlier. Since 1921 when Czech playwright Karel Capek introduced the notion and coined the term robot, these creatures have taken on increasingly more importance both in imagination and reality. The history of the emergence of robots goes into mythology. In ancient Greek sources, Scandinavian myths, ancient legends mentioned the

creation of life in inanimate objects. One of the first robots was made in 250 B.C. [2]. It sounds astonishing with dreams, which they strive to implement!

Data on the first application in practice of the prototype of modern robots or as they were called - mechanical people, refer to the Hellenistic era. At that time, four gilded female figures were installed on the lighthouse that was on the island of Pharos. During the day, these figures shone in the rays of the sun, and at night, they were brightly illuminated, thanks to this they were always well seen from afar. After a certain period, these statues turned, and at night, they made trumpet sounds, warning seafarers of the proximity of the shore [3; p. 152]. Also, the prototype of robots can be considered mechanical figures, which was created by the Arab inventor Al-Jazari (1136-1206). His invention is a boat with four mechanical musicians who played on tambourines, harp and flute.

However, the image of a humanoid robot was served by a drawing made by Leonardo da Vinci around 1495. In the records found, the researchers found drawings of a mechanical knight capable of sitting, pushing apart his hands, moving his head and opening the visor.

It is worth noting that people of all times have sought to knowledge to simplify their lives. But how much life has changed since that time! Modern robots have such impressive abilities that undoubtedly benefits humanity. In this article, we would like to talk about robots that can aid. About



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these mechanical creatures that might change our lives.

Artificial intelligence and robotics in medicine

All inventions are created in order to facilitate a person's existence. With the passage of time, more and more spheres are developing and, accordingly, innovations are becoming more ambitious.

What we used to enjoy in modern life (mobile phones, computers, tablets, social networks, smart applications, etc.), not so long ago was an innovative breakthrough. In this article, we decided to outline that side of innovation that can bring maximum benefit to humanity - medicine.

Medicine is considered a perfect area for the use of robots. Every day it takes up employment in many clinics and hospitals. Medical robots saved lives and health to hundreds of thousands of patients. Annually, the number of "electronic doctors" grows to 20%. For the last 30 years, medical field has implemented enormous changes in treatment and care for people. Artificial intelligence indeed helps to improve patient outcome, computers provide not only examining but also differential diagnosis, treatment and predictions in clinical scenarios. High-profile robotic devices have revolutionized treating human diseases [4].

To a medical field robots came from the industry. In 1985, for the operation on the brain, the manipulator PUMA-560 was used - the brainchild of the pioneer of industrial robotics, the American company Unimation. In parallel, its competitor, led by Frederick Moll, developed for the US Army a prototype robotic surgeon, later named Da Vinci. It is a unique surgical System to operate through just a few small incisions with the help of 3D high-resolution vision system and a tiny human hand for a better precision and control [5]. Da Vinci system assists urologists in patients with prostate cancer to remove the nidus. Since 2000, the company Intuitive Surgical established its serial production. Needless to say, the use of robots in medicine is popular not only in the US. To make the world better, many scientists began to think about how to defeat terrible and incurable diseases, for example - cancer.

Japanese scientists have created a medical artificial intelligence, which in just one second can detect cancer in the human body. Unfortunately, while we are talking only about intestinal cancer, scientists hope that in the future, the algorithms created by them can be used to diagnose the entire human body [6]. In Japan, technology is reaching a new level. Recently, a new intellectual system has been tested, which can perform an optical biopsy in real time. Therefore, artificial intelligence diagnoses intestinal cancer in just a moment. There is a program with enlarged endoscopic pictures of colorectal adenoma - a benign tumor, which can later

turn into cancer. To teach AI scientists used more than 30,000 similar images.

During the decisive test, the scientists checked 300 images from 250 patients. To evaluate each photo, the system spent a little less than 1 second, after which the artificial intelligence put the correct diagnosis with a probability of 94 percent. According to Japanese scientists, the main achievement was that now the "smart" algorithm checks the images and diagnoses in real time.

The most important advantage of such systems is the fact that the quality of their work can be as close as possible to 100 percent accuracy. Thus, already in the near future, only cars can deal with the detection of cancer. All this should improve the effectiveness of treatment, eliminating the risks associated with the "human factor", in particular the incompetence of doctors.

For today, the created system waits for testing and decisions of the local regulator. The project manager Dr Mori hopes that the system will be approved, and in the future, it will help save many lives. Frankly speaking, it is worth noting that scientists from around the world are trying to create early detection systems for cancer. For example, in the UK, the greatest interest is in systems capable of diagnosing lung cancer.

Many people know the application Siri, but in addition to all known properties, the application has a great future in medicine. International Center for Artificial Intelligence SRI (developer of voice assistant Apple Siri) is working on a robot that can be used as a surgeon.

The robot is controlled using a VR-headset, and the joystick and pedals are needed for the robot's movements, which weighs 6.8 kilograms. The robot manager sees what is happening through the cameras built into the "head" of the robot, inside the virtual reality there is also a panel with information, for example, about the patient's indices or the temperature in the vehicle.

The "hands" of the robot are made in the form of a claw; they can hold, for example, a scalpel, a screwdriver and a thread for stitching the wound.

As CNBC notes, with the help of a robot, it is now quite easy to move objects, but it is more difficult to sew a line or move a wire.

According to the director of medical systems and robots, in SRI Thomas Lowe, during the operation to help the robot can resort, if, for example, it is necessary to consult a specialized specialist who is in another hospital. With the help of Taurus, the doctor will be able to perform some minimal tasks.

Lowe admitted that in the future the robot could be used to conduct operations during flights to space, the Republic reports with reference to CNBC.

In Russia, there was also a place for using robotics for medical purposes. For example, in

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Penza, doctors performed a unique operation using a digital robot.

In the Technopark of high technology "Rameev" in Penza, a unique operation was performed: the surgeon removed a cyst of the uterus inside a living organism with the help of a digital robot. The event has become a new high-tech page of Russian medical history, experts say.

Minister of Healthcare in Russia Veronika Skvortsova compared the innovation with Da Vinci, admitting that a new robotic machine is 100 times more accurate. The main advantage is there is no need to be close obtaining a possibility of remote operating [7].

Dmitry Pushkar -a professor, chief urologist of the Ministry of Health of the Russian Federation, conducted the operation. Robot - domestic development. As a patient, the pig -Rose.

Choosing a patient for operation could be shocked. There are a lot of supporters and believers that animal testing is cruel [8]. A simple farm pig from Penza was found uterine fibroids after ultrasound examination by veterinarians. This made scientists think about providing an experiment with a robot assistant for an operation. It was in time selection of a patient, because scientists have been already searching for a suitable pet to be operated for the first time. The opportunity was worth of it, the structure of internal organ of swines is similar to human. Preparing to be operated a chosen patient, a six months old pig spent her waiting time on a special cage, where it was daily examined and treated. In the operation day Rose met her doctors accompanied by journalists in a good mood but with a desire to be fed. It was impossible to conduct a surgery operation after been fed or treated [9].

The operation was performed under anesthesia. From the surgeon and robot to the operating table - a few meters, but the movements of the manipulators were accurate and unmistakable. The robot with the help of the tool captures the tissue - the tumor is cut out by the cell. Then the entrance is a laser, which bloodlessly sews tissues and blood vessels. The doctor is behind the control panel, and he controls the miracle-machine. Many experts really consider this development a miracle. After all, this is the country's first medical robot, developed by domestic specialists.

After the successful operation it is obvious that Rose has good chances to give birth to piglets, and have good and healthy offspring. Few days later a patient was in a satisfied condition, in a good mood.

The innovative robot was developed as an alternative to the American device "Da Vinci".

Domestic production has a number of advantages, in addition to the fact that the robot is cheaper; it is also more lightweight and compact. Miracle-doctor was brought from Moscow in a suitcase. Assembling took only a couple of hours. True, not all the possibilities of an intelligent device are yet open, as developers keep this information in secret.

Note that the digital robot was conceived at the Moscow State Dental University, established by the Institute of Design and Technological Informatics of the Russian Academy of Sciences by our scientists. For the first time it was tested at the Penza Technopark.

Robotics tomorrow

We tried to outline the essential innovations in robotics in the medical field. The impact of robotics on medicine is undeniable, the success of described robots attracts and inspires new scientists day after day. Clinical robots improve quality of life by helping to get rid of serious diseases and promoting recovery. Engineers hope that in the future robot-assist will replace laparoscopy. For example, in the morning, the patient has surgery, and in the evening he is already at home. It is planned that the robot will become the most important medical tool for the very near future, including in the fight against cancer.

The creators of the robot have not yet given the name to the smart machine. They hope to conduct hundreds of test operations. If they succeed, during a short time the robot surgeon will go into mass production. Everyone was worried about the fate of the mumps. But the "Iron Doctor" took only 40 minutes to remove the cyst. About the state of her patient, doctors say - that the mumps Rosa will necessarily bring offspring.

We strongly believe, this is a real achievement, both in medicine and in the technical sphere of Russia.

It seems to us many interesting and helpful innovations will be discovered in near future or maybe devices that we know now will be improved. Take an example the robot that was created in Moscow, we suppose its functions are unknown. Today this device has operated the pig, but tomorrow it will heal a person. We pretty sure that this creation can change our medicine. Because very soon people will be operated quickly and without side effects. As it was mentioned above all known innovations are created from people's wishes. The hand that rocks the cradle is still the hand that rules the world, so people have boundless opportunities to change their tomorrow.

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