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WP1 BIOART Report

Evaluation on Existing Curricula

P03 Zaporizhzhia National Technical University (ZNTU)

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1. Current Status in Zaporizhzhia National Technical University and connected Colleges

a. Existing biomedical courses proposed as a specialization – B.Sc Level

Currently in Zaporizhzhia National Technical University(ZNTU) biomedical courses are not offered to students as specialization of studies at the level of B.Sc. The implementation of such specializations at the B.Sc. level at this time is complicated due to the necessity of the previous re-accreditation of the basic specialties. That is, since most specialties have been automatically renamed in accordance with the Resolution of the Cabinet Ministers of Ukraine dated April 29, 2015, No. 266, external accreditation is required before introducing changes and opening of the new specialization.

b. Existing biomedical courses proposed as a specialization – M.Sc Level

Currently in ZNTU biomedical courses are not offered to students as a specialization at the level of the M.Sc. level. But unlike the B.Sc. level, according to the Order of the Ministry of Education and Science № 1151 from November 6, 2015 "On the peculiarities of the introduction of the list of areas of knowledge and specialties under which the training of higher education graduates is possible, approved by the Resolution of the Cabinet of Ministers of Ukraine from April 29, 2015, No. 266" the opening specialization "Biotechnical and medical devices and systems" to the technical specialty 172 "Telecommunications and radio engineering" which is preparing at the Radioelectronics and Telecommunication Department is possible.

c. Existing Full curriculum biomedical courses – B.Sc Level

Zaporizhzhia National Technical University prepares B.Sc. for a biomedical specialty in full curriculum. Currently biomedical courses offered to students are carried out within the framework of the direction 22 "Health" of specialty 227 "Physical therapy, ergotherapy". Training is carried out in the following courses:

i. Ground courses

- Human anatomy – 12 credits EKTS, 360 hours;
- Biochemistry – 8 cr., 240 h.;
- Hygiene – 5 cr., 150 h.;
- Basics of nosology – 5 cr., 150 h.;
- Human physiology – 9 cr., 270 h.;
- The basics of a healthy lifestyle and a general theory of health – 4 cr., 120 h.;
- Basics of cosmetology – 5 cr., 150 h.

ii. Specialization courses

- Therapeutic and recreational swimming – 10 cr., 300 h.;
- Therapeutic physical culture – 3 cr., 90 h.;

- Methods of rehabilitation in cosmetology – 3 cr., 90 h.;
- Fundamentals of physical rehabilitation – 9,5 cr., 285 h.;
- Prevention of sports injuries – 5 cr., 150 h.;
- Psychology in rehab – 3 cr., 90 h.;
- Information technology in rehab – 3 cr., 90 h.;
- Sports medicine – 2 cr., 60 h.;
- Theory and technology of recreational activity – 1 cr., 30 h.;
- Physiological bases of physical culture – 2,5 cr., 75 h.

d. Existing Full curriculum biomedical courses – M.Sc Level

ZNTU prepares M.Sc. for a biomedical specialty in full curriculum. Currently biomedical courses offered to students are carried out within the framework of the direction 22 "Health" of specialty 227 "Physical therapy, ergotherapy". Training is carried out in the following courses:

i. Ground courses

- Ethics of Business Relationships in Rehabilitation – 3 кредити ЄКТС, 90 годин;
- Imageology and PR in the Field – 3 cr., 90 h.;
- Methods of Scientific Research in the Field of Sportive Rehabilitation Technologies – 4,5 cr., 135 h.;
- Survival Training and Safety Standards in Work Place – 3 cr., 90 h.

ii. Specialization courses

- Basics of Balneology – 4,5 cr., 135 h.;
- Professional Kinesiology – 3 cr., 90 h.;
- Sports Traumatology – 4,5 cr., 135 h.;
- Sports Pharmacology – 4,5 cr., 135 h.;
- Physical Rehabilitation in Neurology – 7,5 cr., 225 h.;
- Physical Rehabilitation in Pediatrics – 3 cr., 90 h.;
- Physical Rehabilitation in Therapy – 7,5 cr., 225 h.;
- Physical Rehabilitation with Physiotherapy Facilities – 7,5 cr., 225 h.;
- Functional and Laboratory Diagnostics in Sport – 4,5 cr., 135 h.



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Labor Market Analysis

a. Preliminary Work

According to the state procurement plan for the last year, the most demanded were in Ukraine: endoprosthesis of the hip joint, knee joint, endoprosthesis for oncological patients, implants and instruments for correction of complex scoliotic deformities of the spine in children and adolescents.

In general, Ukrainian enterprises produce "passive" and traction prostheses, which provide a minimum of functionality, as well as dental implants and implants of the breast.

The designing and manufacturing of all this product is carried out by a number of enterprises in the region, as well as other regions of Ukraine. In addition, a number of companies in Ukraine and in particular Zaporozhye region produce medical equipment and tools.

Institute of Spine and Joint Pathology im.M.Sitenko: experimental and theoretical studies of the problems of spine injuries and diseases, orthopedic arthrology and endoprosthetics, orthopedic oncology. <http://www.sytenko.org.ua>

Inmasters Ltd. (Kharkov): design and production: orthopedic and surgical instruments, implants for the spine and joints using ion-plasma spraying and ceramic coating; manufacturing: dense samples of products for orthopedics and traumatology, corsets, head-holders (collars), orthoses, insoles insole. <http://www.inmasters.net>

Ukrainian Research Institute of Prosthetics, Prosthesis and Rehabilitation (Kharkiv): development of prosthetic and orthopedic products and their production technologies.

Prosthetic and orthopedic enterprise Biotechnika, LLC (Kharkov): production of prostheses and orthopedic products.

Kiev state experimental prosthetic and orthopedic enterprise: prosthetic and orthopedic products.

Ukrainian Center for Veteran of Afghanistan Rehabilitation (Kiev): Development and manufacture of prostheses of the lower and upper limbs extremities, silicone prostheses. <http://www.prosthesis.com.ua/ru/>

Odessa experimental prosthetic and orthopedic state enterprise: production of orthopedic equipment, products and adaptations.

Nikolaev experimental prosthetic and orthopedic enterprise: manufacturing of prostheses, orthoses, orthopedic footwear, bandages, corsets

Vinnitsa state experimental prosthetic and orthopedic enterprise: production of prostheses, orthoses, orthopedic shoes. Products: Hospital, medical, dental and veterinary equipment; orthopedic equipment; physiotherapeutic and rehabilitation equipment and prostheses. <http://vkepop.com.ua>



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Lviv state experimental enterprise of means of transportation and prosthetics: manufacture and sale of vehicles for the disabled. <http://www.protez.com.ua>

Kharkiv state experimental prosthetic and orthopedic enterprise: design and manufacture of prosthetic arms, feet, hands, legs, hips, elbow and knee joints. <http://khkepop.com.ua/produksiya/protežno-ortopedicheskie-izdeliya/>

Poltava experimental prosthetic and orthopedic state-owned enterprise: production of orthopedic products, appliances, prostheses.

Sumy prosthetic and orthopedic state-owned enterprise: production of orthopedic products and prostheses of upper, lower limbs and orthopedic footwear.

Dnipro state experimental prosthetic and orthopedic enterprise: manufacture of prostheses of the upper and lower limbs, orthopedic footwear, orthoses, orthopedic insoles, tutors, corsets, bandages, headholders, hinges of ankle and knee <http://www.dkepop.dp.ua>

PJSC MOTOR SICH (Zaporizhzhia): endoprotheses of the hip and knee joints, as well as tools for conducting operations <http://actual.today/s-zaporozhskimi-jendoprotezami-znakomilis-vedushhie-travmatologi-ukrainy/>

Zaporizhzhia department of prosthetic and orthopedic products: prostheses of any designs, fixing and correcting corsets, apparatuses and tutors, bandages, orthopedic and special footwear, orthopedic and diabetic insoles, breast prostheses with bodices. <http://zpc.dkepop.dp.ua/>

Specialized prosthetic and orthopedic company Ortokom, LLC. (Zaporizhzhia): bone implants, artificial femoral joints, orthopedic implants, metal intramedullary rods, lower limb prostheses; correcting and fixing corsets; tutors, lower limb orthoses; orthopedic insoles <http://www.ortocom.net/>

VITAPLANT, LLC (Zaporizhzhia): system of dental implants, one-stage and two-stage implants.

BIP, LLC (Zaporizhzhia): production of in-channel titanium pins, titanium dental tools and dental products made of high-quality titanium alloy.

MEDPROMSERVICE, LLC (Zaporizhzhia): manufacture of medical, surgical and orthopedic equipment

OPTRON, SPF, LLC (Zaporizhzhia): Fiber optic endoscopes, head lamps and mirrors. <http://www.optron.org.ua/>

MEDTEKHNIKA CENTER 1, LLC (Zaporizhzhia): repair and maintenance of medical equipment.

KASMED, PK (Zaporizhzhia): repair of medical equipment and instrumentation. www.kasmed.narod.ru

Alycyone, LLC (Kiev): medical, physiotherapeutic, orthopedic, rehabilitation equipment.



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ROBOTMETALLURGINVEST, SCIENTIFIC PRODUCTION AND INDUSTRIAL FIRM, LLC (Dnipro): development and production of rehabilitation facilities for the disabled, the elderly and children.

Company "Medintustriya Kiev": medical equipment, sterilization, physiotherapeutic, dental, diagnostic, laboratory equipment, medical instrument, optics and ophthalmology
MEDTRONIKA, LLC (Kiev): medical and diagnostic equipment.

Research and production enterprise "DX-systems", LLC (Kiev): medical computer equipment for functional diagnostics, electrocardiographs, electromyographs, encephalographs, computer rheographs, specialized chairs for electrophysiological research, software.

Graduates of this specialization will also be in demand as consultants in medical institutions that actively use these technologies:

1. Clinic of orthopedics and sports trauma of Zaporozhye regional hospital;
2. Department of Traumatology and Orthopedics of the Zaporozhye State Medical University;
3. Department of Traumatology and Orthopedics of the city clinical hospital emergency and emergency medical care;
4. Department of Traumatology and Orthopedics of the City Clinical Multiprofile Hospital No. 9;
5. Department of Traumatology and Orthopedics of the medical unit of MOTOR SICH PJSC.

b. Trends and requirements in the industry

The market of high-tech implants and prostheses is not developed in Ukraine.

There are no manufacturers of exoskeletons, bio-, neuro- and cyber prostheses, implants for the treatment of diabetes, to improve brain activity, to stimulate the growth of internal organs, auditory and ocular implants.

We need appropriate specialists and new solutions for the design and manufacture of prostheses and implants, which are effective and provide maximum physiology.

For example, the bionics laboratory of the Massachusetts Institute of Technology (USA) is developing smart prostheses, in which modern materials are combined with microelectronics. Laboratory Neural Engineering (West Virginia University, Morgantown, USA) is developing a bionic approach in prosthetics, which is based on detailed modeling of the musculoskeletal system of the human body and the neural processes that are controlled.

The main trends in the development of modern approaches in prosthetics:

- development of bionic prostheses based on control with the help of various signals from the brain and muscles;



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- usage of modern technologies of 3D printing with medical polymers;
- new precise technologies and equipment for metalworking for the manufacture of prostheses;
- new technologies for injection molding of refractory metals;
- development of computer interfaces for the brain, allowing to control robotic prostheses;
- development of exoskeletons for neurorehabilitation - including after strokes and neurotrauma.
- usage of mobile devices to control the prosthesis.

3. Prospects of Project Implementation

Since the Zaporizhzhia region has a well-developed system of training professionals in the Health sector, which also includes ZNTU, we consider it expedient to pay more attention to the development of biotechnical and medical-technical education in our region. With a fairly wide coverage of the specialties in purely medical care, there is almost no training for specialists in the development and maintenance of medical equipment, implants and prostheses, based on the current level of development of electronics, information and communication technologies. Such a situation impedes progress in the field of healthcare and reduces the possibilities of healthcare institutions in terms of using modern technology.

a. Involved Departments

For the implementation of the new Curricula in Artificial Implants for Bio-Engineering there will be taken as basis 3 specialty:

- curricula 172 "Telecommunications and Radio Engineering", which is prepared at the Radio Engineering and Telecommunications Department
- curricula 122 "Computer Sciences", which is prepared at the Software Tools Department
- curricula 22 "Health", which is prepared at the physical rehabilitation department.

The use of graduates is planned in the medical organizations of the region: in hospitals and diagnostic centers.

Departments to be involved in ZNTU to complete this work:

- Radio Engineering and Telecommunications Department, which is the basic department of specialty 172, and carries out studding of bachelors in this specialty;
- Software Tools Department, responsible for the discipline of intellectual processing of information;
- Department of Special Education and Rehabilitation, having experience and personnel for teaching disciplines of medical direction;



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- Material Science Department, which has experience in creation of new medical materials and alloys.

List of measures to be implemented:

- preparation of curricula for specialization "Biotechnical and medical devices and systems";
- approval of curricula at the level of the Scientific and Technical Council of ZNTU;
- development of courses in biotechnical and medical-technical direction;
- conducting vocational guidance and organizational work for the Bachelors that like to be specializing in medical - technical area;
- adaptation of the courses and curricula to take into account regional interests in informational and technical maintenance of medical equipment and implants manufacturing in the region.

b. Risk identification

Since the timelines of the BioArt project are limited to a certain period, it is planned to open the M.Sc.'s specialization only. This creates a risk to get a not full amount of students, as it involves changing the choice of specialization for students and a small amount of students that will get education by cost of government budget. But, since the medical-technical specialists are rather scarce not only for our region, but also for adjacent areas, this risk will be offset by increasing requirements of labor market in this area and a small full cost of training during the 3 semesters.