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Review Article

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Interdisciplinary Approach in the Solution of Problems of Teaching of Bioethics and Physiology in Saint-Petersburg State University

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This article is dedicated to the bioethical problems in natural, medical sciences, the humanities and the higher education. The Potter bioethics as an interdisciplinary science broadens his research interests and develops new methodologies, strategies. The higher medical education has the modern alternative principles of 3R that have replaced partially some vivisection methods. This is the excellent example of the removal of special contingent inhumanity. The modern experimental biology and the teaching of medical students turn on such improvements in technique. Usage of the modern alternative principles of 3R is demonstrated with an example of education medical students at the Medical faculty of Saint-Petersburg State University

Keywords: Physiology, Bioethics, Medical Education, Research, Experiment, 3R- Principles

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Background

Biomedical ethics is an important part of studying medicine. This discipline is a part of education of medical students. It has been considered since the times of Hippocrates that a physician is a philosopher as there is not much difference between medicine and the philosophy of treatment. The principles of humanism declared in the 20th century compelled the academic community to keep ethic standards in any research.

The humanism principles in the higher medical education in Russia are very important. Special medical subjects included in the curriculum of Medicine faculty are a priority. Nevertheless, humanitarian subjects, including bioethics, are aimed at the development of moral values in the process of education in medicine. Biomedical ethics as an interdisciplinary subject plays a key role in medical education. In the curriculum there is a dilemma connected with the importance of the theory of the humane treatment of animals and people participating in research. Professors of the departments of physiology and ethics of St. Petersburg State University propose to resolve this dilemma by combining the efforts of two disciplines within the educational process. In the modern world bioethics, while conforming to requirements of the macro ethics, solves the most important problems of global survival. Biomedical ethics, focusing on anticipation, detection and understanding of dilemmas in medicine, gives priority to the maintenance of people's life. «Moral and legal education, especially of young scientists, ensured creating of favorable conditions for realization of ideals and the principles of bioethics.

Bioethics is a new ethics related to preservation of life on Earth and health of all people» [1 p.142]. Bioethics as a research area constantly expands the investigation fields and develops new techniques. As it heads for perspective research, the education of future generation of young scientists should be a priority field. As a strategy – the most successful is the combination of two approaches of interdisciplinary [the complex scientific method of research of a problem] and integration [the introduction of results of multidisciplinary research in training system]. It is the interdisciplinary approach that permits to gain better understanding of social and professional responsibility of future physicians.

Problem Areas

The idea of creation of a new science, the bioethics, was offered by Van Potter in 1970, it was essential and timely. The priority direction of the bioethical research is human life, its moral qualities, and social communication. The bioethics considers people not only as biological species but also as cultural personalities.

The ethical standards help to form individual and social moral values, develop understanding of responsibility for the actions. The highest principle of medicine «First, do no harm» is the professional principle of any physician. The postulate «to rescue the person from the person» remains essential.

Integration [as an introduction, influence and interaction] is a most important component of curriculum in modern teaching methodologies. The applied aspect of integration in the education process of higher school is the interdisciplinary training. Relevance of interdisciplinarity was defined in the 60-70s of the 20th century.

Bioethics possesses the qualities of interdisciplinary integration and allows solving ethical problems of physiology teaching. It teaches a precautionary approach to all the living things in any research. Ethical standards of the researcher in medical practice were created on the basis of ethic and legal documents: Nuremberg code, Helsinki declaration, etc. [2].

The existing system of professional training of doctors in St. Petersburg State University is aimed at training in methods of diagnostics and treatment of patients. The problem of humanization of medical education at the Medicine faculty is solved by the Department of Ethics of the Institute of Philosophy of St. Petersburg State University. Studying the bioethics is planned at the first year in the curriculum. However, students are not capable yet to appreciate the importance of this discipline for their future professional activity. As a result, students are not able to put into practice the moral rules and categories, to tell good from bad, subjective from objective, cause from effect. As a result, it is also evident that not all students studying subjects are capable of coming to the level of a medical judgment. Only in the course of time students realize the importance of questions of philosophy and bioethics. This idea exists in the

Article «Philosophy in «Mede» by the student of the fourth year Alexander Suchkov in the newspaper «The 21st line»[3].

Physiology teaching in the course of centuries required vivisection, as an important component of knowledge about functions of an organism. The famous physiologists L. Galvani, C. Matteucci, I.M. Sechenov, etc. traditionally conducted experiments on laboratory animals. The importance of experiments on animals in medicine was emphasized by academician I.P. Pavlov. Great attention was paid to the problem connected with using alternative methods instead of animals. In the 20th century a wellknown American bioethicist Michelle Bolz offered his definition of this concept: «Alternatives are training resources or conceptions of learning which stop the use of animals doing no harm to them, or supplement the existing humane education» [N. N. Karkishchenko's translation]. [4] Though the vivisection carried out by the Department of Physiology conform to the requirements of the European Convention for the protection of Vertebrate animals used for experimental and other scientific purposes [No 123, Council of Europe], they set off a negative emotional reaction among students, which reduces the perception and the assimilation of the material. In connection with the above mentioned facts, it is necessary to use modern educational resources and practical techniques for studying the functions of an organism, but not just change the object of the research.

«3R» Principles

In 1954 W. M. S. Russell, a zoologist and a psychologist, and R. Burch, a microbiologist, offered the principles of a humane technique of experiment 3R. 3R means reduction, refinement, replacement [5].

Refinement is the improvement with the aim of humanization of preparation and carrying out an experiment from the beginning of management of an animal in the laboratory conditions to its death with the use of nontraumatic methods and anesthetics.

Replacement is different technologies of replacement of animals by other models and techniques. Reduction is receiving the results by the correct planning of the experiment, the use of healthy animals of the needed standard according to ecological and genetic status.

Types of alternatives used in higher education

- Models and simulator devices [educational manikins, the surgical exercise training device, the computerized imaging, etc].
- Audiovisual aids
- Students' experiments on themselves
- Tests «in vitro»
- Multimedia computer modeling [virtual laboratories for carrying out different experiments]

Types of alternative methods of training at the Department of Physiology of the Medicine faculty, St. Petersburg State University:

Audiovisual Aids

Video films on topical issues of classical and modern physiology are used at practical classes of the department. The films «Physiology of the Respiratory system, neural control of breathing», «The automatism of the heart», «Stannius ligatures on the frog heart», [Stannius ligature is an experimental procedure to illustrate impulse conduction in frog heart], «Physiology of Behavior» [film illustrating physiological mechanisms of behavior and its modulation by environmental factors] and others show regulatory mechanisms of body functions and systems. The history of development of physiology and the attitude of some Russian scientists to laboratory animals are revealed in the films «I.P. Pavlov's Doctrine about Conditioned Reflexes», «Pirogov, the heaven-born surgeon». Educational films «Nature of Synoptic Transfer», «Function of Secondary Messengers», etc. represent the phenomena and processes which are out of human view. Interactive animations «Uropoiesis processes», «Structure of the juxtaglomerular apparatus, glomerular filter», «Mechanisms of hormonal action», etc. demonstrate the physiological processes and mechanisms of cellular functions at cellular and molecular levels by using the animated images, schemes, captions and sound.

The use of actual video focuses on the mentality of modern students. The visual and audio perception of information improves the cognitive ability of its assimilation and adapts these methods to real conditions. An important aspect in such approach to training is the possibility of multiple watching of educational films and interactive animations

By students during independent studying of the sections of physiology.

Our experience shows that modern presentation of video aids corresponds to students' perception and therefore they assimilate the information very well. The visual and audio perception of information improves the cognitive ability; adapts these methods to real conditions. An essential part of such approach in training is also that students can repeatedly watch educational films and the interactive animations in class and at home [6, 7].

Computer-based learning programs of virtual and interactive physiology

The physiology stimulator «LuPraFiSim» is used at practical classes. The «LuPraFiSim» imitates all classical experiments according to the core units of physiology. These experiments are traditionally carried out on laboratory animals under vivisection [8]. Our experience shows that the lessons connected with a decapitation and anatomical dissection are a certain challenge for students in the sense of their ethical principles. This situation increases their stress levels and decreases the perception and assimilation of information and the motivation. The use of the physiology stimulator «LuPraFiSim» completely conforms to ethical standards of treating the laboratory animals established under legislation. The virtual laboratory-based course has a number of advantages in comparison with real laboratory experiments. For example, when studying the influence of different types of stimuli [physical, chemical, mechanical] on regulatory mechanisms of the cardiac function of the isolated heart, a group consisting of 10 students needs to have 2-4 frogs. However, carrying out some investigations with the physiology stimulator «LuPraFiSim» gives the opportunity to do this work without the use of animals. In the course of the experiment it is possible to change the purposes and objectives of research step by step without any harm to animals when using them. In this case all conditions are present for students to use their creative activity within the research if the needed requirements for a satisfactory experiment are satisfied.

Often the organization of an experiment is impossible due to objective reasons even on an experimental animal. For example, it is impossible to investigate the value of surfactant

For decreasing the superficial tension in lung alveoli in the conditions of a standard educational experiment, but it becomes absolutely real using the physiology stimulator «LuPraFiSim».

According to our experience, students are interested in experimenting with computer models as they already possess high level skills for working with modern computer equipment and digital audio-video. These skills enhance the training effect and create strong motivation increasing the quality of training. The students get educational tools which make them not only the observers, but also the active participants of some experiments.

Physiological research of students on themselves

In physiology laboratories of the department there is often no modern laboratory equipment which would allow conducting the investigations the object of which is a human. The result is that the role and the value of basic research in the curriculum are underestimated. Noninvasive diagnostic methods of functions of body systems by using the computer program «Biopac» provide the opportunity for students to experiment on themselves. Three factors, in this case, make this program preferable. First, it allows registering various graphic characteristics displaying the function of important parts of a human body, e. g., the spirogram, the electrocardiogram, the phonocardiogram, the sphygmogram, the encephalogram, etc. Secondly, the program «Biopac» demonstrates the harmlessness of manipulations being carried out and the high informational content of the obtained data. Third, using it students deepen the theoretical knowledge received at lectures. Independently conducted investigations cause curiosity, involvement and, of course, are well remembered because students act in two roles: a researcher and a person being tested. Practical approach used by the authors in carrying out the laboratory research develops students' physiological thinking and ability to see an etiology behind a lot of different symptoms. These qualities promote the formation of medical judgement in the course of educational activity. In this way teachers lead students to solving similar tasks in «real-life» clinical practice at the clinic of diagnostics and estimation of body functions. The «Biopac» complex allows investigating and estimating some human functions which previously students could

Study only in the process of vivisection on animals. For example, they can independently measure the nerve conduction velocity along the ulnar nerve of a human and monitor the process. The obtained data allow not only to estimate the nerve conduction of an elbow, but also to determine the level of blocking the conduction of the nervous impulse. The computer program «Biopac» allows to carry out the analysis of the obtained results with the following detailed statistical analysis [9-11].

Clinical physiological research of Student Research Society in St. Petersburg hospitals

In the course of professional training of a future doctor his medical judgement is being formed [11-13]. It is the authors` opinion that it is necessary to begin the medical judgement formation from the clinical physiological research. Such research provides using and transforming of theoretical basic principles into professional knowledge and skills. This is achieved by involving students who make good progress in the work at hospitals of St. Petersburg. Students under teachers` guidance research the microcirculation and the lymphatic draining in patients with circulatory depression in the LL and with lymphedema in hospital № 4 «Saint George» and hospital № 32. Several groups of students carry out an investigation using LDF [laser doppler flowmetry]. The students' findings help clinicians to estimate the degree of disorder in blood circulatory system and lymph flow system. Students' results are published in scientific reviews [14] and awarded diplomas and certificates including international ones.

Conclusion

The practical application of the 3R-principles demonstrates that successful use of integration in the curriculum of Medicine faculty not only brings positive results in acquisition of knowledge, but also develops the necessary ethical principles in a future specialist. The basic concepts of «mercy», «humaneness», «empathy» become understandable. The need for empathy and sympathy as education elements becomes an important part of the education process and the future application in professional activity. This fact is confirmed by many published papers which discuss the developed conflicts between students and higher education institutions because of ethical contradictions about the use of experimental Animals in experiments. Biology students, veterinarians and medical students often are not able to hurt a living being, according to the principles of humaneness and the empathic feeling. The condemnation of vivisection methods may be exemplified by the opposition of two students to the teachers of the Institute of Veterinary Medicine and Zootechnics of DALGAU who demanded to carry out inhumane experiments on homeless dogs and cats. [14] For many practicing physicians the vivisection methods are similar to mistreatment of defenseless animals. The other case happened to R. Belousov, a biology student of the Moscow State University. Following the ethical principles, he refused to cut frogs. The case came to the court as his institution expelled him because of his refusal to take part in vivisection. The microbiology student demanded to replace vivisection by alternative methods, which was rejected. [15] Compassion to animals and the humane attitude to all living organisms are sometimes perceived as a challenge to the training system, a student's inability to continue the training and his incompetence as a future specialist. Undoubtedly, there are some branches of medicine where physicians cannot but use the operative intervention in educational process. In such cases student surgeons have to vivisect on animals to develop their skills. However, it is obvious that there should not be callousness and sadism in surgery.

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