

## MEDICAL BIOPHYSICS YESTERDAY, TODAY, AND TOMORROW

The word “Biophysics” was used allegedly by *Karl Pearson* in his book *The Grammar of Science* for the first time in 1892. Medical physics appeared even earlier, in the middle of the 19th century, which is connected with the name of *Adolf Eugen Pick*, the author of diffusion laws. When looking at the Czech scientific history, we cannot omit the father of Czech and Slovak medical physics, *Professor Viktor Teissler*, or the founder of the Institute of Biophysics of the Czech Academy of Sciences, *Professor Ferdinand Herčík*. The two scientists and teachers are more or less connected with the history of the Faculty of Medicine of Masaryk University in Brno.

The synthesis of biophysics and medical physics resulting in medical biophysics was a gradual process. The introduction of X-ray diagnostics and electrodiagnostics, investigation and utilisation of ionising radiation in therapy, understanding bioelectric phenomena, the imposing appearance of tomographic imaging methods, permanent attention paid to the risks connected with physical diagnostic and therapeutic methods, invasion of knowledge about molecular biophysics – these are the main roots of modern medical biophysics.

In the past, medical physics encompassed selected chapters of physics with some particular importance to medical students. Only in the 2nd half of the 20th century it was transformed in a distinctive branch of science, which started to flourish in all medical faculties of the Czech and Slovak Republics. This synthesis involved physical and biophysical problems including medical technology and principles of informatics and cybernetics. Among other teachers, *Professor Ivo Hrazdira* is a man of great merit for the establishment of the new conception of medical biophysics.

It is not easy to be a medical biophysicist. Biophysicists with medical education are rather frustrated by insufficiency of their knowledge in mathematics and physic. Physicists, engineers, or even biophysicists do not often feel satisfied with an atmosphere full of poorly understandable medical terminology. A communication problem exists. It is almost impossible to have education both in physics and in medicine. Even the few biophysicists with medical orientation have to accommodate to the medical milieu for a long time. In the best case, an experienced medical biophysicist can serve as a good interpreter in discussions involving physicians and other scientists. Fortunately, biophysicists are mostly well accepted by their colleagues with medical education.

What about the perspectives?

The present time can be denoted as transient. The old approach, involving explanations of the classical analogue medical technology, is waning. We have to think deeper of what is in front of us. We should keep in mind that the anticipation of the future state of medicine is of extraordinary importance in the very subject taught by ourselves. Remember, for example, the diagnostic ultrasound, which started to develop in the fifties of the last century. We can find only sparse remarks on that topic in textbooks from the sixties, but it became well known ten years later being an essential examination method today. If somebody had taught nuclear magnetic resonance to medical students 30 years ago, (s)he could be taken to be a fool. Today it is necessary to explain this topic very thoroughly. The same could be said about shock waves, etc.

Modern medicine cannot be imagined without apparatuses and devices based on physical principles. It is clear that a physician will need ample knowledge of physic. Unfortunately, it is the knowledge of the most complex physical problems – nuclear and quantum physics, optics, and thermodynamics. We cannot say *correctly* what problems we have to expect. Moreover, the physician should be capable of exact and logical thinking. He or she will need it for reasonable utilisation of their brain capacity, and also for the communication with computerised diagnostic and therapeutic systems, which cannot be mastered only by intuition or using some empathy. Of course, communication with an engine is not – and will not be for a long time yet – an analogy of the communication with the patient. I am sure that the latter is more important. However, mastering technologies is very important for avoiding situations where the physician is only able to be a soother or a routine technician dealing with tubes, frameworks, and information centres of the human body. In the past, it was believed that logical thinking was supported by the knowledge of Latin and mathematics. However, today's medical students are not bothered about mathematics and Latin was reduced to just a minimum. Thus, physics and informatics could be a good substitute for them.

What is ahead of us? In my opinion, besides the stabilised chapters on general and molecular biophysics, biophysics of perception, nuclear physics or optics, we have to start with the principles of biosignal processing, transducers, analog-digital converters, processing of digitised data, etc. Thus, we cannot neglect filtering, frequency analysis, image processing, etc. Some mathematics seems to be unavoidable.

Let the XXVIIIth Days of Medical Biophysics, held from May 25–27 in the Valtice Castle, Czech Republic, be a successful contribution to the search for new ways and approaches in medical biophysics.

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