

MEDICAL PHYSICS EDUCATION AND TRAINING IN POLAND

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Abstract— Medical Physics in Poland has a relatively long tradition. To say that Maria Skłodowska-Curie was the very first Polish medical physicist would be a simplification. However, she had a huge contribution to the development and understanding of medical physics in Poland. The training of human resources initiated by Marie Curie was passionately continued by her followers, even in spite of the economic difficulties typical of the economy of communist countries. Also today, there is in Poland a dynamic development of medical physics observed, both in clinics and at the academic level. Poland has a very clear National Registration Scheme, which is fully compliant with EFOMP recommendations. It covers all recommended topics and fields of study. The Polish NRS was one of the first six approved by EFOMP.

Keywords— Medical Physics, Education, Accreditation and Certification, Training

I. INTRODUCTION: HISTORY AND DEVELOPMENT OF MEDICAL PHYSICS IN POLAND

It should be said that medical physics in Poland from the very beginning, i.e. from the beginning of the 20th century, found fertile ground for development. Young physicists, inspired by the successes of our great compatriot Maria Skłodowska-Curie, willingly decided to continue her work. Development continued despite the dark period of World War II and the long years of the Iron Curtain.

Maria Skłodowska-Curie, living in exile in Paris, actively supported her countrymen who remained in her homeland. Her dream was to establish the Radium Institute in Warsaw. For this purpose, the Radium Institute Society was established in 1921 and Maria became its honorary chairman.

Maria Skłodowska personally participated in the conceptual work on the Institute's project as she had considerable experience in organizing research laboratories. It was intended to be an institution in which therapy should be carried out in conjunction with scientific work. Clinical activity was to have a status equal to that of research. It was a very innovative solution for those times [1].

The construction of the Institute at Wawelska Street in Warsaw (it still exists today) began in 1925 [1,2]. Apart from supervising the construction works, Maria made efforts to obtain the necessary research staff for the

Institute. For this purpose, close cooperation with the University of Warsaw was established. One of the first delegates for an internship in Paris, to the laboratory run by Curie, was Cezary Pawłowski, who had just defended his PhD dissertation in physics.

The purchase of the laboratory equipment was financed by the Polish state and numerous donations from private individuals, including Maria Skłodowska's family: Dr. Bronisława Dulska (sister) and Irena Curie-Joliot (daughter) [2]. The primary radioactive source of radium, on the other hand, came directly from Marie Curie. In 1934, Pawłowski became the head of the Physical Laboratory at the Radium Institute. Following the solutions observed in Paris, Pawłowski established two sub-laboratories: the Calibration Laboratory and the Laboratory for Measurements of Radioactive Substances. The intention was that both laboratories were to perform dosimetric measurements for other treatment facilities in Poland. The Calibration Laboratory is still operating with the SSDL (Secondary Standard Dosimetric Laboratory) status. It was the only scientific institution in occupied Poland to operate legally, also during the war (from the beginning of its activity in 1937 until the end of the war, over 640 calibrations were performed). The Radium, prepared chemically, survived the war, hidden by Pawłowski underground in the garden adjacent to the Institute.

In 1946, Pawłowski became a professor at the Warsaw University of Technology. Thanks to his efforts, a new field of study was created at the Faculty of Communications: electromedicine, as a specialization after three years of general studies. Graduates of these studies for many years expanded the staff of the Maria Skłodowska-Curie Institute of Oncology (nowadays National Institute of Oncology), which was established on the basis of the Radium Institute.

The Polish Society of Medical Physics (PSMP), named after Prof. Cezary Pawłowski, continues the ideas promoted by the Radium Institute Society. In 2020, the Society had nearly 400 active members, the vast majority of whom deal with the use of ionizing radiation in medicine.

II. EDUCATION AND TRAINING

In order to become a Medical Physicist in Poland, one needs to complete a master's degree (EQF 7) in physics, medical physics or related studies, such as biomedical

engineering, technical physics and biophysics. It is an absolute condition for starting work in the clinic and next for commencing postgraduate education. This “specialization education” is carried out in accordance with EFOMP and EU recommendations. Education at the master's level may take place at several universities, both colleges and universities of technology. Students have the opportunity to undergo practical classes and internships in a selected oncology centre.

After completing the 3.5-year training, which consists of theoretical and practical modules, the physicist must pass the state examination. Specialization in the field of medical physics in Poland has the same rank as medical specialization and it is for life.

Specialization training in Poland in the field of medical physics was first established in 2011. Since then, the teaching programme has been updated twice. Currently the educational programme covers theoretical education (specialization courses) at 536 hours and practical training (internships) at 880 hours [3]. During the specialization, the candidate should complete a basic internship of 580 days of professional activities in the workplace in accordance with the specialization programme. The content of the curriculum is provided in Table 1.

Table 1 Content of the curriculum

Content	Days	Hours
MODULE I General module		
- specialization courses	23	138
MODULE II Radiotherapy		
- specialization courses	22	132
- directional internships:		
1. external beams radiotherapy	50	400
2. brachytherapy	20	160
MODULE III Imaging diagnostics		
- specialization courses	14	84
- directional internships:		
1.X-ray and ultrasound diagnostics	15	120
2. magnetic resonance imaging	5	40
MODULE IV Nuclear Medicine		
- specialization courses:	8	48
- directional internships:	20	160
THE ONE COURSE		
Medical law	2	12
Basic specialization internship	480	4640
Self-education – evidenced by supervisor	18	144

The teaching courses are conducted by experienced specialists employed in accredited oncology centres. Postgraduate education of medical physicists and other medical professions in Poland is regulated and supervised by the Medical Centre for Postgraduate Education. After completing the specialization training, a medical physicist passes the state examination. The institution responsible for conducting specialization exams in areas applicable in health care in Poland is the Medical Examinations Centre.

The state examination is carried out twice a year, i.e. in the spring and autumn sessions. The examination committee appointed by the Medical Examinations Centre consists of representatives of the Ministry of Health (National Consultant in the field of medical physics), outstanding specialists appointed by professional institutions supervised by the Minister of Health and representatives of the Polish Society of Medical Physics.

The Society actively contributes to the scientific and professional development of medical physicists in Poland by organizing courses, conferences, scientific conventions and congresses. Points are awarded for participation in individual activities, which are the basis for the evaluation of professional development. Active participation of specialists in Continuous Professional Development (CPD) is the basis for applying for the title of Medical Physics Expert at the PSMP.

The most recognizable meeting in the country organized by the PSMP is the Congress of PSMP, which is organized every two years. The second one is the Autumn School of Medical Physics (ASMP). The School was founded in the late 1980s. The meeting was initially a local event organized by the Oncology Center in Bydgoszcz, but quickly gained the status of a national event. Nowadays it is organized every two years and deals mainly with radiotherapy, x-ray diagnostics and nuclear medicine topics. ASMP plays an important role in the medical physics community in Poland by integrating the community and providing an opportunity to exchange professional experiences.

Regional branches of PSMP organize their own events. Some of them host not only colleagues from their neighbourhood, but also from all over the country. It is worth mentioning, for example, the Silesian Medical Physics Seminars organized in cooperation with the University of Silesia. The Seminars are held every two years in the Beskid mountains. The programme of the event covers the full scope of medical physics. MP students have also an opportunity to present their MSc or PhD theses here.

The PSMP also acts as a partner of several events organized by universities, scientific centres and independent hospitals. These are, inter alia, the “Young Scientists Forum” organized since 2001 by Greater Poland Cancer Center in Poznań and “Physics for a Medic” held at AGH University of Science and Technology in Kraków. The YSF is held in English, usually about 15 speakers present projects in radiobiology, medical physics and clinical radiotherapy to an international competition committee. The Physics for a Medic conference is organized on the initiative and by the Student Scientific Association KERMA. The event attracts a large number of students (almost 200) from 20 Polish universities.

As PSMP brings together medical physicists from various fields, such as radiation protection, nuclear medicine, brachytherapy or radiotherapy, each profession also meets in its own group within the so-called section meetings.

The Society publishes its own periodical, the Polish Journal of Medical Physics and Engineering, which is available at <https://sciendo.com/journal/pjmpe>. [3,4]

III. INFRASTRUCTURE

Poland, with almost 40 million citizens, has exactly 50 radiotherapy centres – including public and private ones (data for the beginning of 2020). Several of them additionally have smaller satellite facilities located in smaller towns.

The total number of linear accelerators used in external beam radiotherapy is currently 168. Four centres in Poland have additionally installed Cyber Knife accelerators and two centres possess Gamma Knife units. There is also one proton therapy centre. In brachytherapy, HDR units are mainly used (57 devices), but LDR and PDR devices (5 and 3 units respectively) are also used [5].

About 500 medical physicists are employed in radiotherapy. Physicists also work in x-ray diagnostics, MRI and non-ionizing imaging, radiation protection and nuclear medicine throughout Poland – 29 PET scanners (including PET-MRI) and 22 SPECT-CT scanners operated in nuclear medicine departments in 2020.

Nearly 67% of medical physicists in Poland have the title of specialist or they are in the process of specialization training.

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