IOMP PROFESSIONAL AND EDUCATIONAL ACTIVITIES

THE HISTORY, DEVELOPMENT, AND REALISATION OF MEDICAL RADIATION PHYSICS EDUCATION IN SWEDEN

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Abstract— **This paper describes the history of Swedish medical radiation physics education and gives details of the core curriculum of today's 5-year specialised medical radiation physicist programme, which fulfils the need to educate clinical physicists with versatile basic knowledge and skills who are well prepared for professional life in all sub-areas of medical radiation physics and radiation protection. The education of medical radiation physics in Sweden has traditionally had a high international reputation, and goes back as an academic education to the mid-1950s.**

'Medical Physicist' became a protected professional title and a state-registered health care profession in 1999. Physicists must now hold a licence to practise any sub-area of the profession, that is, diagnostic radiology, nuclear medicine, magnetic resonance tomography, or radiation therapy. In addition, the medical physicist must obtain expert skills and knowledge in radiation protection of both ionising and non-ionising radiation.

The university departments at Gothenburg, Lund, Stockholm and Umeå Universities, have the authority to award a degree of Master of Science in Medical Physics. These departments have in close symbiosis with their respective university hospitals developed the education programmes over more than 50 years, aim to produce qualified medical physicists with expertise in all the fields of medical radiation physics to meet the changing needs of the health-care sector and society at large. The programmes also provide a good academic grounding and a scientific approach, preparing graduates for a future research career.

Keywords— **medical physicist, medical physics, education, health care profession, Sweden.**

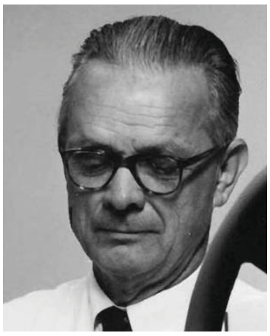
I. THE LONG ROAD TO BECOMING A HEALTH CARE PROFESSION

The early use of X-rays beginning in the early 20th century for diagnostics and radiotherapy, as well as the introduction of radium for treatment, were developments that relied on the empirical work of radiology pioneers. Some collaboration took place with physicists in industry, manufacturing equipment, applicators, and instruments. However, the rapid increase in the use of radiation made it necessary to have radiation physics expertise in house at hospitals, a fact that was early recognised in Germany, England, and the United States, and soon afterward in Sweden. In early 1920, Rolf Maximilian Sievert (1896–1966) was employed at the 'Radium Home' (Radiumhemmet), or Radiotherapy Department at Stockholm University, which had been founded 10 years earlier by the surgeon Johan Berg and the oncologist Gösta Forssell [1]. Sievert started his new employment in a modest five-square-metre physics laboratory, and without any salary in the first years (though he was fairly wealthy, since he was the son of a successful industrialist in Germany). Over the years, the size of his department increased, along with its momentous influence on the development of radiotherapy, dosimetry, and radiation protection. Sievert is undoubtedly the 'father of radiation physics' in Sweden, and is honoured worldwide by the adoption of his name for the unit of equivalent and effective dose, the Sievert (Sv).

In 1941, Sievert's laboratory became the Department of Radiation Physics of Stockholm University, with a professorship in the Faculty of Medicine and with a national responsibility for radiation protection. The same year, the first Swedish radiation protection law was agreed on by the Riksdag (the Swedish parliament), and the Department of Radiation Physics was responsible for interpretation of and adherence to the law until the National Institute for Radiation Protection was established in 1965. A similar development and academic status of radiation physics followed at Lund University, under Professor Kurt Lidén (1915–1987), at the University of Gothenburg, by Professor Sven Benner (1900–1986), and some years later at Umeå

Rolf Sievert (1896–1966)
Stockholm

Kurt Lidén (1915–1987)
Lund



Sven Benner (1900–1986)
Gothenburg

University, by Professor Gunnar Hettinger (1931–2007). All these departments were and are well integrated with the clinical radiation physics departments at the respective university hospitals, and have a shared academic affiliation to the Faculties of Medicine and Science at their institutions.

Medical physics grew considerably during the 1950s, and the need for a more formal academic society with a wider circle of members with interest in the field became increasingly evident. In 1954 the Swedish Hospital and Health Physicist Society was founded. Later, in 1961, this Society was split into a scientific organisation, the Swedish Society of Radiation Physics [2] and a trade union, the Swedish Hospital Physicists Association [3]. Some of the members of the primary society, mainly the professors Sievert, Lidén, and Benner (Fig. 1), played substantial roles in the continuing development and extension of radiation physics in Sweden during the rest of 1950s, for example in the production of a list of suggested equipment for a medical radiation laboratory, the first programme syllabus for studies in radiation physics, official contact with the authorities on the need for medical physicist positions in hospitals, and the initiation of discussion on medical physics as a health care profession in Sweden. In addition, Sven Benner had a major interest in worldwide dissemination of advances in medical physics; he was a strong supporter of the IOMP, the International Organization for Medical Physics, and was its interim chairman before its formal inauguration in 1963.

Fig. 1 Three pioneers in many fields of radiation physics and radiation protection, and also the initiators of the education of hospital physicists in Sweden during the 1950s.

The increasing use of ionising radiation in medicine and healthcare required educated and trained clinical physicists at hospitals. The very first documented course syllabus for studies in radiation physics was produced jointly by the Universities of Gothenburg, Lund, and Stockholm at the early date of 1955. Initially, special exemption was needed for every student that wanted to study radiation physics, since it was not yet accepted as an ordinary academic degree. In this first syllabus, different definitions of radiation physics were addressed:

- *General radiation physics*, which deals with the physical basics of ionising radiation and interaction with matter;
- *Technical radiation physics*, which deals with the physics and techniques of radiation sources and measurement technology;
- *Radiation biophysics*, which deals with the physical course of events at the interaction between ionising radiation and biological materials,
- *Clinical radiation physics*, which concerns the medical use of ionising radiation for diagnostics and therapy of patients; and
- *Radiation protection physics*, which deals with the harmful effects of radiation on human beings and how they can be prevented.

It was concluded that it would be ideal to bring these branches together into one subject, radiation physics or radiophysics, not only because they belong to the same field of science but also for practical reasons. All these branches require access to similar, costly, and sometimes unique technical equipment and their practical uses are connected and inform one another. In addition, clinical radiation physics builds on results from biophysical radiation research and requires expertise in technical radiation physics, as well as constant awareness of radiation protection. The physics of radiation protection was declared essential to biophysical radiation research, as were technical radiation physics, and biological radiation effects from experience in clinical radiation physics. These are statements that more or less hold even today. The core of medical radiation physics education in Sweden today is dosimetry, dose and image optimisation and radiation protection, irrespective of the branch of the field in question, and the main focus of the core curriculum of the unique medical radiation physics programmes in Sweden.

The rapid research and development of medical physics have positively influenced education in the field. In 1965, it was only possible to study a few individual courses in radiation physics, parallel to physics and mathematics. A few years later, in 1970, radiation physics became its own ordinary examination subject with additional course content focused on the medical use of ionising radiation. In 1980, basic radiation physics was studied through a serious of courses during one-year and a half-year of clinical courses, after two years' studies in basic physics and mathematics, for a total of 3.5 years, corresponding to today's 210 ECTS-points, the European Credit Transfer System. The syllabi and design of courses during this period were very much influenced by two former senior lecturers and directors of studies, Bo Nilsson at Stockholm University and Sven-Erik Strand at Lund University. In the mid-1980s a one-year Master of Science programme was introduced and medical physics education increased to 240 ECTS, which is 160 weeks including 20 weeks' thesis work. This was the situation until the introduction of a licence to practise and state regulation of medical physics as a health care profession in Sweden on 1 January 1999, after years of persistent proposals to the government from the Hospital Physicists Association. The education was extended by an additional term (20 weeks) committed to clinical training and professional development.

As part of the Bologna Process, the series of ministerial meetings and agreements between European countries designed to ensure comparability in the standards and quality of higher education qualifications, Sweden in 2006 implemented the joint European three-cycle system as a qualification framework in higher education [4]. However, the professional programmes were first excluded, but after months of persistent deliberation with the Ministry of Education and Research, the Swedish Parliament agreed to a prolongation of the medical physics programme to five years (corresponding to 300 ECTS) on 26 April 2006. The details of the core curriculum of this programme are given below.

II. Age and gender distribution

Medical physicists in Sweden traditionally specialise in the fields of medical *radiation* physics and radiation protection, that is, fields that involve radiation but normally excluding ultrasound and bioengineering. As recounted above, the academic education tradition in medical physics goes back to the late 1950s. At that time, the number of physicists in medicine was only 30 in the whole country, but by the time the licence to practise was introduced in 1999, almost 40 years after the first proposal to receive status as a health care profession, the number of medical physicists was just above 200, and by the beginning of 2006 this had increased to around 350. By May 2013, the number had further increased to 570 registered and fully qualified licensees, as recognised by the National Board of Wealth and Healthcare. The rapid increase since 1999 is probably linked to the establishment of the status of medical physics as a health care profession, the increased visibility of medical physics in society, the active recruitment of students, and education of schoolteachers to help them integrate basic medical physics into their teaching of fundamental physics concepts [5]. About 450 physicists (full-time equivalents) are working clinically, and the rest are at universities, authorising bodies (e.g. the Swedish Radiation Safety Authority), or in private industry. Their principal fields of activity in medicine and healthcare are radiotherapy (RT), 37%; nuclear medicine (NM), 23%; diagnostic radiology (DR), 19%; magnetic resonance imaging (MRI), 11%; and mixed activities (e.g. NM/MRI, NM/DR), 10%. Almost all medical physicists also have radiation protection as a field of responsibility.

The current age and gender distribution of Swedish medical physicists is presented in Table 1. It is notable that professionals in the field today are fairly young, with 50% younger than 40 years; of these, 45% are women, while of the profession as a whole about 38% are women. Since the population in Sweden is 9.56 million, the number of clinically working medical physicists per million inhabitants is about 45, but of course a concentration is present in city areas hosting university hospitals, as seen in Figure 2. For instance, in the county of Skåne (the location of Lund University), there are nearly 10 physicists per 100,000 inhabitants, while in the counties of Västra Götaland (University of Gothenburg) and Stockholms län (Stockholm University), there are about seven.

Table 1 Age and gender distribution of medical radiation physicists. Figures include staff at universities, authorising bodies, and the private sector (as of March 2013). In Sweden, the retirement age is 65 years with the legal right to work to an age of 67 years.

Age Interval	Fraction	Number	
		Men	Women
< 30 years	19.6%	63	43 (41%)
30–34 years	17.1%	54	43 (44%)
35–39 years	13.3%	36	36 (50%)
40–44 years	15.5%	55	29 (35%)
45–49 years	11.6%	38	25 (40%)
50–54 years	7.6%	26	15 (37%)
55–59 years	5.0%	21	6 (22%)
60–65 years	7.0%	31	7 (18%)
66–67 years	2.6%	12	2 (14%)
All ages		336	206 (38%)
> 67 years (retired)		31	8 (20%)

III. Competencies and functions

The National Board of Health and Welfare has published the document 'Competencies for Medical Physicists', giving a more detailed description of and guidelines for the profession [6]. The Board states that:

'*As an expert on radiation and radiation protection in medical care, the medical physicist co-operates in the use of ionising and non-ionising radiation. The medical physicist's occupational field comprises patients – children, youth, adults and elderly people – who in different medical disciplines and areas in a hospital or any other medical field, are examined or treated by radiation-based diagnosis (diagnostic radiology, nuclear medicine or magnetic resonance imaging) or radiation therapy or are undergoing any other analysis, diagnosis, or treatment with ionising non-ionising radiation (e.g. ultrasound, UV light, microwaves, and laser light). The medical physicist works on radiation protection for patients and personnel and on radiation protection of the general public and the environment.*'

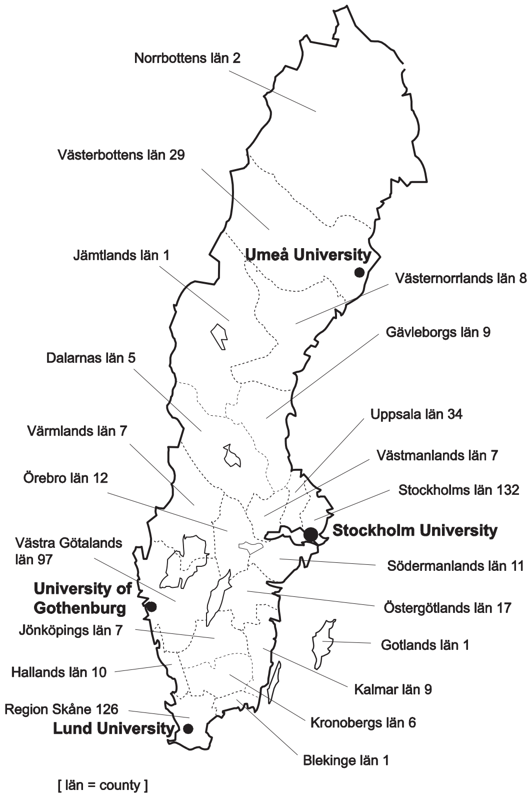


Fig. 2 The number and county distribution of Medical Physicists with License to Practise in Sweden, March 2013. Source: National Board of Health and Welfare.

IV. Degree and learning objectives

Responsibility for higher education in Sweden rests with the Swedish Higher Education Authority. A description of the goals for a Master of Science in Medical Physics is given in the Higher Education Ordinance (1993:100), §32, '*Sjukhusfysikerexamen 300 hp'* (300 ECTS), that is, the Degree of Master of Science in Medical Physics [7]. The national learning goals under this ordinance are divided into *i*) *knowledge and understanding, ii*) *skills and abilities*, and *iii*) *judgment and approach*, and are as follows:

Scope

A degree of Master of Science in Medical Physics is obtained after the student has completed course requirements consisting of 300 higher education credits.

Objectives

For a degree of Master of Science in Medical Physics, students must demonstrate the knowledge and skills required for certification as a medical physicist.

Knowledge and understanding

For a degree of Master of Science in Medical Physics, students must

- *demonstrate knowledge of the scientific basis of the field and insight into current research and development work, together with knowledge of the connection between science and proven experience and the significance of this connection for professional practice;*
- *demonstrate both broad and deep knowledge of physical, biological, and technical aspects of radiotherapy and image and functional diagnostics, together with the application of this knowledge in the health services;*
- *demonstrate knowledge of planning, leading, and coordination in the professional field; and*
- *demonstrate knowledge of relevant legislation, particularly in the area of radiation protection.*

Skills and abilities

For a degree of Master of Science in Medical Physics, students must

- *demonstrate a deep ability to independently apply mathematical and scientific methods in all activities involving radiation in health and medical services;*
- *demonstrate an ability to exercise responsibility for and carry out necessary quality-assurance work concerning both equipment and working methods in activities involving radiation;*
- *demonstrate an ability to integrate knowledge from relevant areas and to independently and critically analyse, assess, and deal with complex phenomena, issues, and situations;*

- *demonstrate an ability to develop, use, evaluate, and optimise new methods in the area;*
- *demonstrate an ability to initiate, plan, lead, coordinate, and evaluate preventive radiation protection work in health and medical services, for both staff and patients;*
- *demonstrate an ability to engage in teamwork and cooperation with other professional groups, together with an ability to provide information and training to staff in radiation protection work; and*
- *demonstrate an ability to provide information about and discuss new facts, phenomena, and issues with different groups, orally and in writing, in both national and international contexts, so as to contribute to the development of the profession and of professional activities.*

Judgment and approach

For a degree of Master of Science in Medical Physics, students must

- *demonstrate self-knowledge and a capacity for empathy;*
- *demonstrate a capacity to make assessments based on a holistic approach to the human person and on relevant scientific, social, and ethical aspects, paying particular attention to human rights;*
- *demonstrate an ability to take a professional approach to patients and their family members;*
- *demonstrate an ability to identify ethical aspects of their own research and development work; and*
- *demonstrate an ability to identify their need for further knowledge and continuously upgrade their capabilities.*

Independent project (degree project)

For a degree of Master of Science in Medical Physics, students must have completed an independent project (degree project) worth at least 30 higher education credits, within the framework of the course requirements.

Other

For a degree of Master of Science in Medical Physics, more precise requirements also apply as determined by each higher education institution itself, within the framework of the requirements in this qualification description.

V. SYMBIOSIS BETWEEN EDUCATION, RESEARCH, AND CLINICAL EXPERIENCE

Medical physics education and degrees are regulated not only by the Higher Education Authority but also by the Universities, which work in very close symbiosis with the clinical medical physics departments at their respective university hospitals. The four major universities – Gothenburg, Lund, Stockholm, and Umeå – all have the authority to award a degree of a Master of Science in Medical Physics. The degree qualifies the physicist for a licence to practise. Students normally apply directly from upper secondary school to the medical physics programme, beginning with an emphasis on physics and mathematics. The number of study places in Sweden as a whole is approximately 48 per year (12 per programme).

The university studies are divided into two years of basic physics and mathematics and three years of medical radiation physics, and like studies for all health care professions, they include clinical training and a MSc thesis. The respective programmes at the four universities have fairly similar curricula and syllabi. In a national evaluation 2007, the Swedish Higher Education Authority ranked the medical physics programmes as one of the best health care professional training programmes in Sweden, due to the high quality of the theses, the many senior lecturer and professors, and also clinically active hospital physicists with strong scientific skills and competences, and the close connection to on-going research, which is embedded in the teaching.

The four Departments of Medical Radiation Physics have responsibility for specialised medical physics education, which in each case is a joint programme between the Faculties of Science and Medicine. The core curriculum of the programmes aims to produce qualified medical physicists who are competent and secure in their professional role and able to act independently, and who possess the necessary knowledge, skills, and approaches to meet the changing requirements of the healthcare sector and society at large. As in almost all health care professions in Sweden, clinical training is integrated within the university programmes, which also aim to provide a good academic grounding with a scientific approach in preparation for a future professional career. Specifically, the programmes shall provide the students with the necessary research skills, both in theory and practice, to prepare them for third-cycle studies (usually a PhD degree).

Teaching is divided into lectures, individual and group projects, group discussions, student seminars, point-/counterpoint discussions, laboratory work, and clinical training. Emphasis is given to the student's own independent activities, peer-review of student's projects, and reflections, and a considerable portion of the learning activities is based on real, everyday problems and cases. This means that beyond expert knowledge in medical physics, there is a requirement that academic teachers, as well as instructors and lab work supervisors (senior clinical medical physicists), are pedagogically skilled. Most laboratory work is carried out using the hospitals' clinical equipment and devices. Twenty weeks are set aside for clinical training in the hospital's medical physics department and related departments such as nuclear medicine, including nuclear pharmacy and cyclotron production of radionuclides; diagnostic radiology; magnetic resonance; and radiation therapy. Special syllabi have been developed for this training in collaboration with clinical physicists to make sure that it includes the most essential tasks in everyday clinical work.

For the degree of Master of Science in Medical Physics, more precise requirements apply, as determined by each higher education institution within the framework of the Higher Education Ordinance. As exemplified by the curriculum at Lund University, they are as follows. Each graduated medical physicist, as a medical physics expert in both ionising and non-ionising radiation for health services and the community, within their professional field, shall:

- *be able to contribute to the optimisation of image and functional diagnostics, using their specialised knowledge and understanding of processes in medical physics, in order to ensure the best possible investigative and/or treatment results with the least possible risk of injury to the individual or society*;
- *have a subject specialisation which, together with good knowledge of radiological statutes, facilitates work in radiological protection, research, and development, primarily within healthcare, but also for society in general*;
- *exercise leadership within their professional field and promote the development of new methods, the introduction of new equipment, quality assurance, optimisation, and preventive radiological protection for both staff and patients*;
- *adopting a professional approach towards patients and their relatives as a member of staff, be able to provide information about any radiological risks involved in the various examinations and treatments, as well as being able to educate various professional groups in health and medical care on the topics of radiological protection and optimisation*;
- *be able to identify problem areas; analyse, formulate and propose measures to address them on a scientific basis; and reassess them on the basis of new scientific evidence*;
- *have the ability to inform the general public about the use of ionising and non-ionising radiation, its significance for society, and the risks radiation entails*; *and*
- *with their knowledge and understanding of the occurrence of radioactive substances and radiation's consequences for people, animals, and the environment, be able to analyse problems and to formulate and carry out measures in the case of radiological incidents or catastrophes*.

These objectives are achieved through broad and deep academic studies and training in the various areas upon which the subjects of medical radiation physics and radiation protection are based. Although there may exist differences between the four education programmes and the courses they include, the more than about 150 detailed learning outcomes for compulsory courses as stated in the respective syllabi are quite similar.

VI. PROGRAMME COURSE FLOW

As mentioned above, the four programmes are nearly identical and specify the same learning outcomes, but some differences exist concerning course flow. For the first two years, students study in Departments of Physics and Mathematics, and from the fifth term, in Departments of Medical Radiation Physics located at the university hospitals. After completing the core curriculum and passing the examinations, the graduated student can apply for a licence to practise from the National Board of Health and Welfare. Medical physicists who pass the examination are registered by this authority as fully qualified medical physicists (QMP) and experts in radiation physics. The course flow and content of the programme at Lund University are given in Table 2.

Table 2 Course flow (Lund University).

First and second years: Basic Physics and Mathematics

Term 1 (1–30 ECTS) 20 weeks	**Physics 1: General course in Physics, 30 higher education credits.** *Mechanics and Electro-magnetism. Waves, optics, quanta, energy and experimental projects).*
Term 2 (31–60 ECTS) 20 weeks	**Mathematics: Analysis 1, 15 higher education credits.** *Linear equation systems. Matrices. Analytical geometry in three dimensions. The basic sets of continuity of functions of one variable. Integrals. Taylor's formula. Generalised integrals and series. First- and second-order standard differential equations and their applications.* **Mathematics: Algebra 1, 15 higher education credits.** *Basic characteristics of integral numbers and real numbers. Induction. Combinatorics. Polynomials and algebraic equations. Cartesian coordinate system in plane and linear equations. Complex numbers. The function concept. The elementary functions. Numerical sequences. Elementary one-variable analysis comprising limits and continuity, derivatives, and curve construction.*
Term 3 (61–90 ECTS) 20 weeks	**Physics 2: Mathematical Tools in Science, 30 higher education credits.** *Mathematical and computational tools; numerical tools. Quantum mechanics. Laboratories and project work.*
Term 4 (91–120 ECTS) 20 weeks	**Physics 3: Modern Physics, 30 higher education credits.** *Atomic and molecular physics. Nuclear physics and reactors. Solid-state physics. Particle physics, cosmology, and accelerators.*

Third year: Radiation Physics and Medical Radiation Physics

Terms 5–6 (121–180 ECTS) 40 weeks	**Medical Radiation Physics, Basic Radiation Physics, 60 ECTS.** *Production and interaction of ionising radiation – theory (10). Radiation detectors and measuring methods – theory (6). Problem-solving – production, interaction, and detectors (6). Radiation dosimetry (8). Medical terminology and fundamental principles (7). Radiation biology (7). Non-ionising radiation (9). Radioecology and general radiation protection (7).*

Fourth year: Medical Radiation Physics

Term 7–8 (181–240 ECTS) 40 weeks	**Medical Radiation Physics, Medical Physics, 60 ECTS.** *Digital image processing and its mathematics (9). Physics of ultrasound (3). MR-physics (8). Physics of radiology (8). Physics of nuclear medicine (12). Physics of radiation therapy (16). Biostatistics (4).*

Fifth and final year: Medical Radiation Physics

Term 9 (241–270 ECTS) 20 weeks	**Clinical Training and Legislation, 30 ECTS.** *Medical ethics (3). Legislation (3). Clinical training and professional development (24).*
Term 10 (271–300 ECTS) 20 weeks	**Master's Degree Project in Medical Radiation Physics, 30 ECTS.**

VII. Postgraduate education and training

Postgraduate education and continuing professional development (CPD) is mainly a responsibility of the profession itself, and is coordinated by the Swedish Society of Radiation Physics and the Swedish Hospital Physicist Association. These associations work together with the universities and the departments of medical physics to promote postgraduate education and CPD on the basis of EFOMP guidelines [8] and especially on the requirements of the Swedish healthcare system.

A CPD programme was established in 2005 and curriculum developed to implement a five-year training period leading to qualification as a 'specialised medical physicist'. In addition to this CPD effort there are also periodic programmes for PhD students, which are of interest for clinically working physicists as well. The PhD programme covers four years, with one-and-a-half years of full-time theoretical studies and around two-and-a-half years devoted to the dissertation. A PhD is generally required for higher positions in the field, and at about 40% of Swedish medical physicists hold a PhD degree.

VIII. Final remarks

The foundation of Swedish medical physics education and the field's status as a state-registered health care profession was laid down more than 50 years ago by the pioneers Rolf Sievert, Kurt Lidén, and Sven Benner (the last, one of the initiators of the IOMP). Today's specialised regiment of medical radiation physics education builds on a long tradition where teaching is closely connected to clinical activities and research. The curriculum provides the medical physicist with broad, deep knowledge and adequate skills for employment as a qualified medical physicist with license to practise and an expert in radiation protection.

Acknowledgement

This paper is dedicated to my former and present colleagues, with whom I have had the privilege to work for many years, and not least to all the students who have become competent, skilful medical physicists with expert knowledge. Together, their persistent efforts have built a leading medical physics education system closely connected to clinical experience and research in all fields of medical radiation physics, as well as a proud tradition in radiation protection.

References

2. Walstam R (1995) Therapeutic radiation physics: A review of the developments in Sweden. Acta Oncol 34:1941-1050
3. Swedish Society of Radiation Physics at www.radiofysik.org
4. Swedish Hospital Physicist Association at www.sjukhusfysiker.se
5. Bologna Process – The European Higher Education Area at www.ehea.info
6. Jönsson B-A. (2005) A case study of successful e-learning: A web-based distance course in medical physics held for school teachers of the upper secondary level. Med Eng Phys. 27:571-581
7. National Board of Health and Welfare (2001) Kompetensbeskrivningar för sjukhusfysiker (Competencies for medical physicists) (www.socialstyrelsen.se/publikationer 2001-105-1)
8. Swedish Code of Statutes, SFS No: 1993:100. Ministry of Education and Research, Sweden. Higher Education Ordinance (SFS 1993:100). Professional qualification: Degree of Master of Science in Medical Physics (Sjukhusfysikerexamen) (SFS 2006:1324)
9. EFOMP Policy Statement No. 8: Continuing Professional Development for the Medical Physicist, Physica Medica 1998;XIV:81-83

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