The Present Status of Medical Physics Education and Training in Europe. New perspectives and EFOMP Recommendations.

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1 INTRODUCTION

Since its inauguration during the second conference of representatives from European organisations for Medical Physics in London in May 1980, one of the main objectives of the European Federation of Organisations for Medical Physics (EFOMP) has been to harmonise and promote the best practice of Medical Physics in Europe.

To achieve this goal, EFOMP has produced a number of unanimously adopted documents called "Policy Statements", making recommendations on the appropriate general responsibilities and roles of the Medical Physicist and proposing guidelines for Education, Training and Accreditation Programmes in Medical Physics. The most recent objectives of the EFOMP documents have been recommendations to implement Continuing Professional Development for Medical Physicists, and Guidelines on Professional Conduct. The total number of Policy Statements to date is 11.

The first of these documents, Policy Statement No. 1 [1] was published at a very early stage, in 1984. It was entitled: "Medical Physics Education and Training: The present European level and recommendations for its future development", and it represents the starting point of the EFOMP recommendations on Education and Training in Medical Physics.

To produce the document, it was necessary to be informed about the current state of development of Education and Training in Medical Physics in each European country. For this purpose, two fact-finding inquiries were conducted, as a result of which 19 national organisations for Medical Physics described the current level of education and training in their individual countries.

The results of the inquiry, summarised in the document, provide a global view of the situation on Education and Training in Medical Physics at that time in Europe.

The first EFOMP recommendations on the schemes of Education and Training in Medical Physics and on the education programmes contents were based on these.

Today, more than twenty years later, the content of this Policy Statement No. 1 is obviously obsolete. The organisation of the Medical Physics Education and Training in

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many countries has changed, and more recent EFOMP Policy Statements have been issued that have introduced new concepts and new recommendations that makes thorough revision of this first document necessary.

For example, reference should be made to Policy statements No. 6 [2]: "Recommended Guidelines of National Registration Schemes for Medical Physicists", and Policy Statements No. 8 [3] and No. 10 [4] on Continuing Professional development for medical physicists. Also, in 1991 EFOMP, issued Policy Statement No. 4 [5] on the numbers of qualified physicists needed in a Medical Physics Department, and in the 1993, Policy Statement No. 5 [6] described the advantages, organisation and management of Departments of Medical Physics.

Furthermore, over the last two decades, the Council of the European Union has adopted new Directives on Medical Exposures and EFOMP has issued a series of relevant Policy Statements as a response to this new Legislation. In 1988 EFOMP issued Policy Statement No. 3 [7]: "Radiation Protection of the Patient in Europe. Training of the Medical Physicist as a Qualified Expert in Radiophysics" which was the EFOMP response to the Directive 84/466/Euratom [8]. In 1999, the Policy Statement No. 9 [9]: "Radiation Protection of the Patient in Europe: The Training of the Medical Physics Expert in Radiation Physics or Radiation Technology". This Policy Statement constitutes the EFOMP response to the Medical Exposure Directive, Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionising radiation in relation to medical exposure, and repealing Directive 84/466/Euratom [10].

Other important European issues that will directly affect not only education and training but also the future of Medical Physics as a profession are:
The harmonisation of the architecture of the European Higher Education System, arising from the "Bologna Declaration" [11], for 2010.
The recently issued European directive: "Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications" [12]. This Directive establishes rules according to which *"a Member State which makes access to or pursuit of a regulated profession in its territory contingent upon possession of specific professional qualifications shall recognise professional qualifications obtained in one or more other Member States and which allow the holder of the said qualifications to pursue the same profession there, for access to and pursuit of that profession"*.

EFOMP is now challenged to make recommendations for education and training in Medical Physics, within the context of the current developments in the European Higher Education Area arising from "The Bologna Declaration", and with a view to facilitate the free movement of professionals within Europe, according to the new Directive.

A complete revision of the document now therefore appears to be essential. The aim of this document is to provide an updated view of the present level of education and training in Medical Physics in Europe and make recommendations in view of these new European challenges.

2 THE PRESENT STATUS OF EDUCATION AND TRAINING IN EUROPE

As was done for Policy statement No. 1, the first part of the work consists of collecting the necessary information. To do this in an efficient way, the first task of the working group has been to prepare a questionnaire and send it to the National Organisation for Medical Physics of each country member of EFOMP (NMO).

2.1 The Questionnaire

The questionnaire was structured on a three different parts and the questions were asked in the following subjects:

Part A: Medical Physics education

1. Education requirements to enter the medical Physics education:
   - What degree is required? It is a university degree? How many years of studies does it represent?
2. Degree on Medical Physics:
   - Is there a nationally approved education programme? Is it official? Who has approved it?
   - Does it lead to any "official diploma/qualification"? Name of this diploma/qualification in native language and in English.
   - Is the training programme the same in all centres of education in the country?
   - Where do the education and training take place? (University, Hospital, both)?
   - How long is the programme? (Specify the total time spent in each place)
   - What is the process for assessing the training?
   - Are the centres accredited? Who gives the accreditation?
   - Does the programme include the use of EMERALD material as a support?

Part B: Qualified / Specialist Medical Physicist.

- Is a "diploma" or "licence" required to be allowed to act as medical physicist?
- Who delivers it? Is it official? (i.e. provided by the government)
- Is it the only way to be eligible for the job? Describe the other possibilities if they exist.
- Does the "diploma" or "licence" allow a person to act as a *Medical Physics Expert* (MED Directive) in the country?
- Is the "diploma" or "licence" equivalent to *Qualified Medical Physicist (QMP)* or to *Specialist Medical Physicist (SMP)* (EFOMP definitions)?
- List the areas of competence in which this "diploma" or "licence" allows one to work.

Part C: Registration

1. General information
   - Is there a Register of Professionals in the country?
   - Is it officially recognised by the authorities in some way? Who is in charge of it?
   - Is the Register entrance voluntary or compulsory based?
   - How many registrants do you have? What fraction of practising medical Physicists does it represent?
   - What fraction of applicants has been refused, on what bases?. If the Register is compulsory, what is the consequence of a refused registration?

- What proportion of your registrants has passed through a recognised training scheme and what proportion was accepted because they were already working in medical physics? What criteria were used to include the later group?
- Does the Register identify 2 levels of registrants QMP and SMP?
- Does the Register have a special procedure for including applicants from a foreign country, registered on a foreign approved register?

2. Registration Council
   - Give the names and functions of the registration council members
3. Continuing Professional Development (CPD)
   - Is there a renewal mechanism in the Register?
   - Is it based on a CPD system, as described in EFOMP Policy Statement N.10?
   - How does it comply with EFOMP Policy Statement N.10?

2.2 The Results

The questionnaire was sent to the Presidents of 34 National Organisations for Medical Physics. The following 23 countries participated in the enquiry and responded to it: Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Latvia, The Netherlands, Norway, Poland, Portugal, Russia, Serbia-Montenegro, Spain, Sweden, Turkey and United Kingdom.

The results can be summarised as follows:

Part A: Medical Physics Education

In all countries, the basic educational requirement to enter Medical Physics is a university degree. The degree required is not uniform. Different NMOs refers to it as: Diploma, Degree, First Degree, BSc, MSc, etc. and in the field of: Natural Sciences, Physics, Chemistry, Engineering, or similar. The total duration of these studies ranges from 2 to 5 years at a university.

Concerning post-graduate education in Medical Physics, in 15 of the 23 countries there is a nationally approved education programme. The programme's approval is granted solely by the Ministry of Education or by the Committee of Universities in the following countries: Croatia, Finland, Greece and Latvia, whereas in Austria, the Czech Republic, Denmark, France, Italy, Spain, Sweden and the U.K., the Ministry of Health is also involved in the approval. Germany and The Netherlands, have educational programs approved only by their own National Organisation for Medical Physics, although in the case of the Netherlands, the government has recently given their approval (2005) and Germany is presently involved in the process of obtaining government recognition.

In Austria, Denmark and the U.K. the Ministry of Health approves the educational programme, but the specific programme is run by the National Society of Medical Physics (OeGMP, DSMP, IPEM). In Belgium, the programme is approved by the Federal Agency for Nuclear Control.

Finally, it should be mentioned that in the following countries Education and Training in Medical Physics is not yet regulated, or they do not yet have a nationally approved

programme: Cyprus, Hungary, Norway, Poland, Portugal, Russia, Serbia-Montenegro and Turkey.

Post-graduate education is essentially provided in three ways. First, the university approach, leading to a Masters degree and/or Ph.D. degree in Medical Physics. This is the case for Czech Republic, Finland, Poland, Serbia- Montenegro, and Turkey. The problem in this approach is that the skills of clinical practice may not be well guaranteed because of the little time spent in hospitals: in some cases, "1 or 2 weeks" or "summer practice".
The second approach is solely within the framework of professional practice. This is the case for Denmark, The Netherlands and Spain. In all these countries, the time required is at least of 3 years. With this approach, additional courses are needed to complete the education.
Finally, the third way, the most common, combines University and Hospital training. In this approach, post-graduate education ranges from 1 year (Latvia) to 5 years in Germany.
The total length of the education and training to become a Medical Physicist ranges from 4½ years for Sweden to 9 years for Italy. The time spent in the different countries is detailed in Table I.

Concerning accreditation of the centres where the education takes place:
In 7 countries (Denmark, Greece, Italy, Latvia, Serbia-Montenegro, Spain and Turkey) an official body (Ministry of Education, Ministry of Health, or other governmental agency) accredits them.
For Austria, France, Finland, Germany, The Netherlands and U.K, the accreditation is granted by their own National Organisation for Medical Physics.
Finally, there are some countries which have no type of accreditation of the educational centres. This is the case of Belgium, Croatia, the Czech Republic, Finland, Hungary and Sweden.

The process for assessing training differs depending on the approach in which the post-graduate education is done. When it is based solely within the framework of professional practice, evaluation is made mainly by the assessment of the supervisor, based on periodical reports from the candidate. In the other approaches, the most common way used is a final examination.

Completion of the educational programme leads to a diploma or some qualification in 18 of the 23 countries. It should be noticed that the name of this diploma or qualification is different in each one of them:

- Austria: *MSc in Medical Physics*
- Belgium: *Acknowledged expert in Medical Physics*
- Croatia: *1.degree: Master of Medical Physics / 2.degree: Specialist in Medical Physics*
- Czech Republic: *Professional qualification for pursuing the health profession of radiological physicist*
- Denmark: *Medical Physicist in Diagnostic Radiology; Medical Physicist in Radiation Therapy; Medical Physicist in Nuclear Medicine.*
- Finland: *Phil.-Lic (or PhD) with the degree of Qualified Medical Physicist.*
- France: *Medical and Radiological Physics qualifying diploma (DQPRM)*

- Germany: *Registration certificate*
- Greece: *Post-graduate diploma in Medical Physics (M. of Sc. In Medical Physics)*
- Hungary: *MSc in Medical Physics*
- Italy: *Medical Physics Specialist*
- Latvia: *Professional Master degree in Medical Physics*
- The Netherlands: *Clinical Physicist*
- Poland: *MSc in Technical Physics with specialization in Medical Physics and Dosimetry*
- Serbia-Montenegro: *Specialist in Medical Physics*
- Spain: *Specialist in Hospital Radiation Physics*
- Sweden: *Hospital Physicist degree*
- United Kingdom: *Diploma of IPEM (DIPEM) / Corporate membership of IPEM (MIPEM)*

The "Emerald" material is used as a support in the educational programmes in Denmark, France, Greece, Latvia, Norway (only for RT), Poland, Portugal (only in some hospitals) and Turkey. However, this material is still unknown in some other countries.

Table I summarises the results of part A of the questionnaire.

Part B: Qualified / Specialist Medical Physicist.

The main goal of this part of the questionnaire was to ascertain the essential requirements needed to work as a Medical Physicist in the different countries, and whether the competencies to work as such, are at the level of Qualified Medical Physicist (QMP) or at the level of Specialist Medical Physicist (SMP), both defined by EFOMP [4].

In 14 countries, it is mandatory to hold a diploma or license to work as a MP: Austria, Croatia, Cyprus, the Czech Republic, Finland, France, Greece, Italy, The Netherlands, Poland, Portugal, Spain and Sweden. In some others, such as Belgium and Turkey, it is only necessary that one person holds such a diploma or license in each hospital. In Denmark, the license is only necessary to work as "the responsible" MP, not to work as an ordinary MP. In Germany, it is only compulsory to hold the diploma or license in Berlin. In the U.K. it is mandatory to be registered. In the remaining countries there is no requirement to hold a diploma or license to work as a MP.
The diploma or license is provided by a governmental body (other than the University) in 10 countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Greece, The Netherlands, Spain and Sweden). In Germany, this applies for Berlin only.

In most countries, this diploma is obtained after completion of the whole education and training programme described in the previous section. Nevertheless, in some others there are alternative possibilities to obtain it. Such is the case for Finland, France, Germany and the U.K. where a period of 3-4 years of working experience leads to the same diploma.

In answer to the question:" Does the diploma or license allow a person to act as a Medical Physics Expert (MPE) as defined in the Directive 97/43/Euratom ?", the results of the survey show this is possible in Austria, Croatia, Finland, France, Greece, Italy, The Netherlands, Poland, Spain, Sweden and Turkey.

It should be noticed that the MPE is not defined yet in several countries. Such is the case for the Czech Republic, Denmark, Hungary and Serbia-Montenegro.

In answer to whether the diploma or licence is equivalent to QMP or to SMP (EFOMP definitions), the results showed: in Austria, Belgium, Denmark, France and Greece, the diploma /license allows to work at the level of QMP, whereas in Germany, Italy, The Netherlands, Serbia-Montenegro, and Spain it is equivalent to SMP.

Finally, the areas of competence in which this diploma or licence allows physicists to work differ considerably depending on the country. The most commonly mentioned are Radiotherapy, Diagnostic Radiology and Nuclear Medicine. In the majority of countries this diploma/license allows medical physicists to work in all areas of competencies. In some other countries however, such as Denmark, Germany and the Netherlands, the education and training are specific only for one area, so medical physicists are allowed to work only in one (or two) of the mentioned areas, depending on the initial choice.

The non-ionising radiation field is also considered within the competence of medical physicists in Croatia, Italy, Sweden and UK.

Radiation Protection is a matter of competence only in Croatia, Greece, Italy, Latvia, and Spain and in some institutions only in Sweden.

In Finland, medical physicists also have competencies in Clinical Physiology and in Clinical Neurophysiology, and in the Netherlands in the area of Audiology.

Table II summarises the results of part B of the questionnaire.

Part C: Registration

At present, 15 countries have a Register of Professionals working as medical physicists: Austria, Belgium, Croatia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Latvia, Netherlands, Poland, Spain, Sweden and the U.K.

The Register is "official", in the sense that it is recognised and managed by a governmental body (Ministry of Health, National Board of Health, etc) in 8 countries: Austria, Belgium, the Czech Republic, Finland, Poland, Spain, Sweden and the U.K. For the remainder, it is the National Organisation for Medical Physics who manages the Register by means of their own Registration Board.

Austria, Belgium, Spain and Sweden have two different kinds of Registers: in addition to the "official" register managed by the authorities, the National Society for Medical Physics also has its own register, voluntary-based, whose aim is to better accomplish the EFOMP requirements.

The Register is compulsory in Belgium (the official one), the Czech Republic, Finland, the Netherlands and Sweden. In Austria, Denmark and Spain (the official register), registration is "automatic" in the sense that medical physicists are automatically registered when they obtain their diploma. For the remaining countries, the Register is a voluntary one.

The Register identifies two levels (QMP and SMP) only in Denmark, France and Spain (only for the register managed by the SEFM).

In general, there is no special procedure to include applicants from a foreign country in the National Registers. The most common way consists of an individual assessment of the applicant.

Note that in several countries (Denmark, Germany, and The Netherlands) registration takes place at the beginning of the training, NOT after completion of the training programme, as recommended by EFOMP.

A Continuing Professional Development (CPD) system operates in 12 countries: Austria, Belgium, Croatia, Czech Republic, Denmark, France, Germany, Greece, The Netherlands, Spain, Sweden and the U.K.

CPD is used as a renewal mechanism for the Register in all of them, either partially or fully.

The CPD system fully complies with EFOMP recommendations stated in Policy statement No. 10 [4] only in 9 countries (Austria, Belgium, Croatia, Denmark, France, Germany, Greece, Spain and the U.K). It is presently in the process of adaptation in the Czech Republic and Sweden.
CPD is based on a 5-or 6- years-cycle time in most countries.

Table III summarises the results of part C of the questionnaire.

3 CONCLUSIONS

The most relevant conclusions can be summarised as follows:

- Basic education:
  - In all countries, the basic requirement to enter Medical Physics is a university degree. Master's degree 57%, BSc 30% and the remainder refer to a diploma, a license, etc.
  - The length of the basic university education ranges from 2 to 5 years.

- Post-graduate education in Medical Physics:
  - Unfortunately, Medical Physics education is not yet regulated in some countries.
  - A nationally approved educational programme is in operation in 65% of the countries. Approval is given by the university only in 17 % of them, whereas in 35 % the ministry of health is also involved in the approval. National Societies for Medical Physics having played an important role in setting-up the educational programmes in most countries.

- There are basically 3 different approaches to postgraduate education:
  a) University studies only, leading to a Master's Degree or PhD in Medical Physics (23% of the overall countries)
  b) Hospital only: on-the-job training (18% of the overall countries)
  c) Combining University + Hospital (59%). In this approach the time spent in the hospital ranges from 0.5 years to 3 years.
- The total length of Medical Physics education and training (basic university + post-graduate training) ranges from 4 ½ years to 9 years.
- Completion of the educational programme leads to a diploma/license named very differently in each country.

– Diploma or license to work as a Medical Physicist
  - In 61% of the countries, it is mandatory to hold a diploma or license to work as a Medical Physicist. In 3 countries this is only mandatory for 1 physicist per centre, or only to act as responsible MP.
  - This diploma or licence is "official" in the sense that it is delivered by a governmental body in 61% of the countries.
  - Holding this diploma/license is the only way to be eligible for the job in 39% of the countries. Other possibilities such as: "hold a Master's degree" or "3 years' work experience", are also possible for the remaining countries.
  - It allows one to work as a *Medical Physics Expert (MPE)* in 52% of the countries
  - It is equivalent to *Qualified Medical Physicist (QMP)*, EFOMP definition, in 26% of the countries
  - It is equivalent to *Specialist Medical Physisict (SMP)*, EFOMP definition, in 22% of the countries.
  - It allows one to work in all areas of competence in 65% of the countries, whereas in 3 countries (13%) it depends on the areas selected by the Medical Physicist in their education and training programme (only one or two areas per training programme are possible)

– Register of professionals
  - 65% of the countries have a register for Medical Physicists. In 60% of them, an official body manages the register, whereas in 40% the Board of their own National Society for Medical Physics exclusively does so.
  - The register is compulsory in 40% of the cases and voluntary based in 47%. For the remainder it can be considered "automatic".
  - A renewal mechanism is in operation in 73% of the registers.

– Continuous Professional Development (CPD)
  - A formal CPD programme is in operation in 52% of the countries, fully or partially complying with the EFOMP recommendations.
  - CPD is used as a renewal mechanism in the Register in all of them.
  - The CPD cycle time, credit-point based ranges from 5 to 6 years.

4 EFOMP RECOMMENDATIONS WITH A VIEW TO THE NEW EUROPEAN PERSPECTIVES.

4.1. The Higher Education area by 2010: The Bologna Declaration.

In May 1998, the Ministers in charge of higher education in France, Italy, the United Kingdom and Germany signed the so-called **Sorbonne Declaration** on the "harmonisation of the architecture of the European Higher Education System" [11] at the Sorbonne University in Paris.

On 19 June 1999, 29 European Ministers in charge of higher education signed the Bologna Declaration on establishing the European Area of higher education by 2010 and promoting the European System of higher education world-wide. In the Bologna Declaration [11], the Ministers affirmed their intention to engage in co-ordinating their policies to reach the following short-term objectives:

1. Adoption of a system of **easily readable and comparable degrees** (implementation of the Diploma Supplement)
2. Adoption of a system essentially **based on two main cycles**, undergraduate and graduate
3. Establishment of a **system of credits**, such as in the **ECTS** system.
4. Promotion of mobility
5. Promotion of European co-operation in quality assurance
6. Promotion of the necessary European dimensions in higher education

Subsequent documents issued from the Ministerial Conferences in Prague (19 June 2001) signed by 32 European countries, and in Berlin (19 September 2003) signed by 40 European countries, confirm the commitment to co-ordinating their policies through the Bologna Process to establish the European Higher Education Area [11].

The most recent conference of European Ministers was held in Bergen (19-20 May 2005) and five further countries were welcomed as new participants. There are therefore 45 European countries presently involved in the "Bologna Process". The next Ministerial Conference will be held in London in 2007.

According to the EFOMP recommendations given in the EFOMP Policy Statement N.1, education of medical physicists can be divided into three stages.

The first is to bring the physicist up to a basic standard during an initial period of training at the university in physics, mathematics and other relevant topics in natural science. The second is to introduce medical physics in the post-graduate education and the third is in-service training in hospitals. Once completed, the physicist can be recognised as a medical physicist.

The "Bologna Process" offers a great opportunity to harmonise the first two stages of education in the participating countries:

- The first step should correspond to the initial university cycle; the degree in physics or other scientific areas will be more transparent and equivalent throughout Europe as of 2010. (Lasting 3 years minimum or 4 years, so 180 – 240 ECTS)
- The second step should correspond to a second university cycle leading to a master's degree. (1 or 2 years and up to 300 ECTS).

– The third step is in-service training in hospitals. This in-service training period should consist of at least two years, under the supervision of an experienced Medical Physicist.

Only after completion of these three periods, can the Medical Physicist be considered competent to act independently, and reaching the minimum qualifications required for enrolment in an EFOMP-approved National Register [2] for Medical Physicists as a Qualified Medical Physicist [4].

4.2. Recognition of professional qualification: Directive 2005/36/EC

The recently issued EU document: "Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications" [12] and published on the Official Journal of the European Union on 30-09-2005, defines (Title I, Article 3):

(a) 'regulated profession': a professional activity or group of professional activities, access to which, the pursuit of which, or one of the modes of pursuit of which is subject, directly or indirectly, by virtue of legislative, regulatory or administrative provisions to the possession of specific professional qualifications; in particular, the use of a professional title limited by legislative, regulatory or administrative provisions to holders of a given professional qualification shall constitute a mode of pursuit.

Later, Article 21, defines the principle of automatic recognition on the basis of co-ordination of minimum training conditions. A set of health care professions listed in the Appendix 5, has an automatic recognition through the EU member states, solely based on the co-ordination of minimum training conditions.

In the context of this new Directive, EFOMP aims to achieve recognition of Medical Physics as a regulated health care profession on the basis of co-ordination of minimum training conditions. This will guarantee the best uniformity of knowledge and skills and will facilitate the free movement of professionals within Europe.

The responsibilities of Medical Physicists working in a hospital environment in the areas of diagnosis and treatment of patients do not differ much from those of other health-care professionals. Therefore, EFOMP strongly supports Medical Physics being considered as a health-care profession.

4.3. EFOMP recommendations in view to these new European challenges.

1. EFOMP strongly encourage NMOs to strive to make a university master degree in Medical Physics available at their universities. This master should include the theoretical curriculum contents recommended by EFOMP in their Policy Statements. [1],[7],[9] and in other documents that EFOMP has produced in collaboration with other relevant societies [13], [14]

2. From the EFOMP's point of view, holding a university Master's Degree in Medical Physics, is not a sufficient qualification to work as a Medical Physicist in a hospital environment. To manage patients without supervision, EFOMP recommends a second part in the post-graduate training: at least 2 years' training experience on the job. Only after completion of the 3 step training can a physicist be considered a

Medical Physicist and able to work independently as a Qualified Medical Physicist. (QMP) [4]. The on-the-job training is essential to achieve the competencies to work as QMP

3. EFOMP recognises and values the important role that NMO's have played until now in setting up and managing the education and training programmes for Medical Physicists in most countries. In the future, EFOMP recommends that the NMO's efforts be aimed at involving Health Authorities in the education and training programmes in order to obtain official recognition as a health profession. EFOMP considers it an essential requirement that the Ministry of Health or National Health Authorities be involved in the recognition/accreditation of the post-graduate training (mainly the second part: "on-the job training").

4. EFOMP strongly encourages NMO's to set up a formal CPD programme for Medical Physicists, credit point based, according to EFOMP recommendations. Only after completion of at least 1 cycle, can Medical Physicists enrolled in the CPD programme be considered SMP [4]. The skills needed to achieve the qualification of SMP should not only be based on the total score but also on a minimum period of effective work as Medical Physicist, gaining experience, for at least 1 CPD cycle.

5. The official registers of professionals managed by the authorities are usually very static and renewal mechanisms are usually not planned. EFOMP therefore recommends that NMO's start their own register of professionals, managed by their own registration board, and including some CPD-based renewal mechanism.

5 REFERENCES

[1] EFOMP Policy Statement No. 1: "Medical Physics Education and Training: The present European level and recommendations for its future development" (1984)
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[5] EFOMP Policy Statement No. 4: "Criteria for the Number of Physicists in a Medical Physics Department" (1991)
[6] EFOMP Policy Statement No. 5: "Departments of Medical Physics - Advantages, Organisation and Management" (1993)
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All EFOMP Policy Statements can be downloaded from the EFOMP web site: http://www.efomp.org/policyst.html

APPENDIX I: Results

Table I: Summary of the part A: Medical Physics education and training

COUNTRY	Basic education		Degree on Medical Physics									
	University degree	No. years	National approv. Progr.?	Approved by:	Where the Education take place?	Total years	Time Univ.	Time Hosp.	Centres accred.?	By:	Assessment of the training	Total years MP
Austria	MSc or PhD in Physics, Technical. Physics or electrotechnics	5	YES	BMGF OeGMP	University + Hospital	3 (min)	360 h. + Master Thesis	3years (min)	YES	OeGMP	OeGM: MSc Diploma + evidence of experience BMGF: MSc diploma or OeGM certification	8 (min)
Belgium	License in Physical Science, Chemistry, Engineer or equiv.	4 -5	YES	FANC	University + Hospital	2	1	1	NO		Examination + Thesis	6-7
Croatia	Past: Diplom.Engineer Prof. of Physics. Now: Master of Phys.	5	YES	University of Zageb	University + Hospital	2	simultaneously		Not yet		N/A	7
Cyprus	Master degree in Medical Physics	4 -5	NO		Abroad							N/A
Czech Republic	BSc. Mathematics and Physics	3	YES	Ministry Education Ministry of Health	University only	2-3	2-3	No data	N/A		N/A	5-6
Denmark	MSc in Physics, Engineer or equiv.	5	YES	Ministry of Health. Run by: DSMF	Hospital only	3 (min)	-------	3years (min)	YES	National Board of Health	Supervisor assessment	8 (min)
Finland	BSc or MSc in Physics, Engineer or equiv.	5	YES	Ministry Education	University OR Hospital	2-3 OR 4	2-3 for PhD	4 on-the-job	NO		Final examination	7-8
France	MSc in Physics or related areas (M1)	4	YES	Min. of Education . Ministry of Health (DQPRM diploma)	University + Hospital	2	1	1	YES	Education Board of SFPM	Oral + written exam. Continual evaluation by the training team	6
Germany	Diploma / Master Physics or Engineering	3 -5	YES	DGMP only	University + Hospital	5-3	360 h?	5-3	YES	DGMP only	Oral examination	8
Greece	First degree in Physics	4	YES	Ministry Education	University + Hospital	2 ½	1	1 ½	YES	Ministry of Health	Examinations	6 ½
Hungary	BSc Physical Science or equivalent	3 - 3 ½	Not yet	Ministry Education (only: Master 2 year)	University + Hospital	4	2 (approv)	2 (sugges)	NO		N/A	7 ½ (sugg)
Italy	"Laurea Specialistica : Fisica"	5	YES	University Minister + Ministry of Health	University + Hospital	4	40 %	60 %	YES	Regional Governm.	Examination + final diploma thesis	9
Latvia	Professional BSc in MP	4 ½	YES	Accredit. Committ.	University +	1	½	½	YES	Accreditt.	Examination	5½

	Professional BSc or 5th level professional qualif.			of the Minister of Science and Educat.	Hospital					Com.Min. Scien. Ed	Master thesis	
Netherlands	MSc in Physics	5	YES	Executive Committ. Board Registration of the Dutch Society (From 2005 Government approved)	Hospital only	3	-------	3	YES	Executive Committ. Registrat Dutch Soc	Final examination and compulsory reports every half year	8
Norway	Master	5	NO		Hospital only (working under supervision)	3-5			NO		NO	N/A
Poland	MSc in Physics	5	No data	University	University only	5	5	Some weeks	No data		Final report	5
Portugal (*)	Degree on physics or Physics engineering	4 -5	NO		Hospital only	2	-----	2		Ministry of Health		6-7
Russia	N/A		NOT yet									
Serbia-Montenegro	High degree (Natural Science, Electr. Eng, Nuclear Physics.)	4	NOT yet	Only University	University	1	1	1-2 weeks	YES	University	Examination	5
Spain	"Licenciatura" in Physics, engineering or equivalent	4 -5	YES	Ministry of Health and Ministry of Education	Hospital only	3	------	3	YES	Ministry of Health	Annual evaluation of the trainee, certified by the Hospital Educat. Comm.	7-8
Sweden	2 years University Maths + Physics	2	YES	National Body of Health and Welfare	University + Hospital	2 ½	2	½	NO		No data	4 ½
Turkey	Basic Degree Physical Science or Engineering	4	NO	Only University	University	2 (Master) 4 (PhD)	2 - 4	-----	YES	University	Examinations	6-8
U.K.	BSc (Honours level) in Physics, engineering or allied Science	3 - 4	YES	Departm. of Health. Run by IPEM	University + Hospital	2: DIPEM 4:MIPEM	1	1 2	YES	IPEM	Oral examination of portfolios demonstrating level of competences	5 - 7

(*) For Portugal, the data showed in this table are only available until 2003. In 2005, a new education and training program has been proposed, consisting in 1-year University education at the level of Master of Medical Physics and one more year in-the-job training working under supervision to obtain the professional qualification.

List of abbreviations used in this Table:

BSc: Bachelor's degree
MSc: Master's degree
PhD: Philosophical Doctor (Thesis)
MP: Medical Physicist
OeGMP: Austrian Society for Medical Physics
BMGF: Ministry for Health and Women (Austria)
FANC: Federal Agency for Nuclear Control (Belgium)
DSMF: Danish Society for Medical Physics
SFPM: French Society for Medical Physics
DQPRM: Official French Diploma allowing to work as Medical Physicist
IPEM: Institute of Physics and Engineering in Medicine (United Kingdom)
DIPEM: Diploma of IPEM (after 2 years training)
MIPEM: Corporate Membership of IPEM (after 4 years training)
DGMP: German Society of Medical Physics

Table II: Summary of the part B: Qualified/Specialist Medical Physisict

COUNTRY	Diploma/Licence to act as MP?	Is it official? (Government)	Who delivers it?	Only way for job?	Other possibilities?	Allow to act as MPE?	Equivalent to QMP or to SMP ?	Areas of competence
Austria	YES: Licence	YES	BMGF	YES		YES	QMP (SMP not defined)	Radiotherapy; Nuclear M; Radiology
Belgium	Only 1 per Hosp. (Radiotherapy)	YES	FANC	YES		N/A	QMP	Radiotherapy; Nuclear M; Radiology
Croatia	YES	NO. Only University	University	Will be		YES	QMP	Radiotherapy; Nuclear M; Radiology; Rad. Protection; Non-Ionizing rad.
Cyprus	YES	YES	Ministry of Labour	NO	All qualified Med Phys can be employed	Depending of the years of experience	Depending of the years of experience	All areas of Medical Physics
Czech Republic	YES	NO. Only University	University	NO	Any MSc + courses	MPE not yet defined	N/A	Radiotherapy; Nuclear M; Radiology
Denmark	Only for the: Responsible MP	YES, only for Responsible MP	National Body of Health	NO	To work as an ordinary MP	NO. MPE not yet defined	QMP	Only in 1 or 2 areas of specialization: Radiotherapy; Nuclear M; Radiology
Finland	YES	YES	University + National Authority Medicolegal	YES		YES	N/A	Radiotherapy; Nuclear M; Radiology Clinical Physiol; Clinical Neurophysi.
France	YES (DQPRM)	YES	INSTIN (University) DQPRM defined by low	NO	VAE: New low validation of acquired exper	YES	DQPRM = QMP SMP= after 5 years experience	Radiotherapy; Nuclear M; Radiology
Germany	Only in Berlin	YES (Berlin only)	The Senat (Berlin only)	NO	Personal initiat. or advertising	N/A	SMP	Depend on the areas selected by the MP during his Education & Training
Greece	YES	YES	Ministry of Health	YES		YES	QMP	Radiotherapy; Nuclear M; Radiology; Radiation Protection
Hungary	NO				University Diploma in Phy	No regulation	N/A	N/A
Italy	YES	NO. Only University	University	YES		YES	SMP	Radiotherapy; Nuclear M; Radiology; Rad. Protection; Non-Ionizing rad.
Latvia	NO				Master degree on Phys. or MP			Radiotherapy; Nuclear M; Radiology; Radiation Protection
Netherlands	YES	YES (2005)	Executive Committee for Board registration of the Dutch Society	YES No In Practic	N/A	YES	SMP	Only 1 area per training programme: General Clinical Physics; Radioth; Nuclear M; Audiology; Radiology.
Norway	NO				Get a position and practice for 3-5 years	N/A	N/A	N/A
Poland	YES	YES	Head of the Centre of Medical Examination	NO	Master degree on Physics	YES (from 2005)	N/A	Mainly Radiotherapy. From 2005: QA in NM and Radiology

Portugal (*)	YES	YES	Ministry of Health	YES		YES	N/A	Radiotherapy; Nuclear M; Radiology
Russia	N/A							
Serbia-Montenegro	Not yet (in progress)	N/A	Ministry of Health (will be)	NO	Appropriate Univ. Diploma	Not yet	SMP	Radiotherapy (primarily)
Spain	YES	YES	Ministry of Education	YES	Work under supervision	YES	SMP	Radiotherapy; Nuclear M; Radiology; Radiation Protection
Sweden	YES	YES	National Body of Health and Welfare	YES		YES	Below QMP	Radiotherapy; Nuclear M; Radiology; Non-Ionizing Radiation
Turkey	At least 1 per Centre	NO	Council of Higher Education	NO	N/A	YES	N/A	Radiation Oncology
U.K.	Be registered	YES (in any way)	IPEM	NO	3 years of work	NO	NO (?)	All areas

(*) For Portugal, the data showed in this table are only available until 2003.

List of abbreviations used in this Table:

MP: Medical Physicist
MPE: Medical Physics Expert (Directive 97/43 Euratom)
QMP: Qualified Medical Physicist (EFOMP definition)
SMP: Specialist Medical Physicist (EFOMP definition)
MSc: Master's degree
QA: Quality Assurance
BMGF: Ministry for Health and Women (Austria)
FANC: Federal Agency for Nuclear Control (Belgium)
INSTIN: National Institute for Nuclear Science and Technology (France)
DQPRM: Official French Diploma allowing to work as Medical Physicist
IPEM: Institute of Physics and Engineering in Medicine (United Kingdom)

Table III: Summary of the part C: Registration and CPD

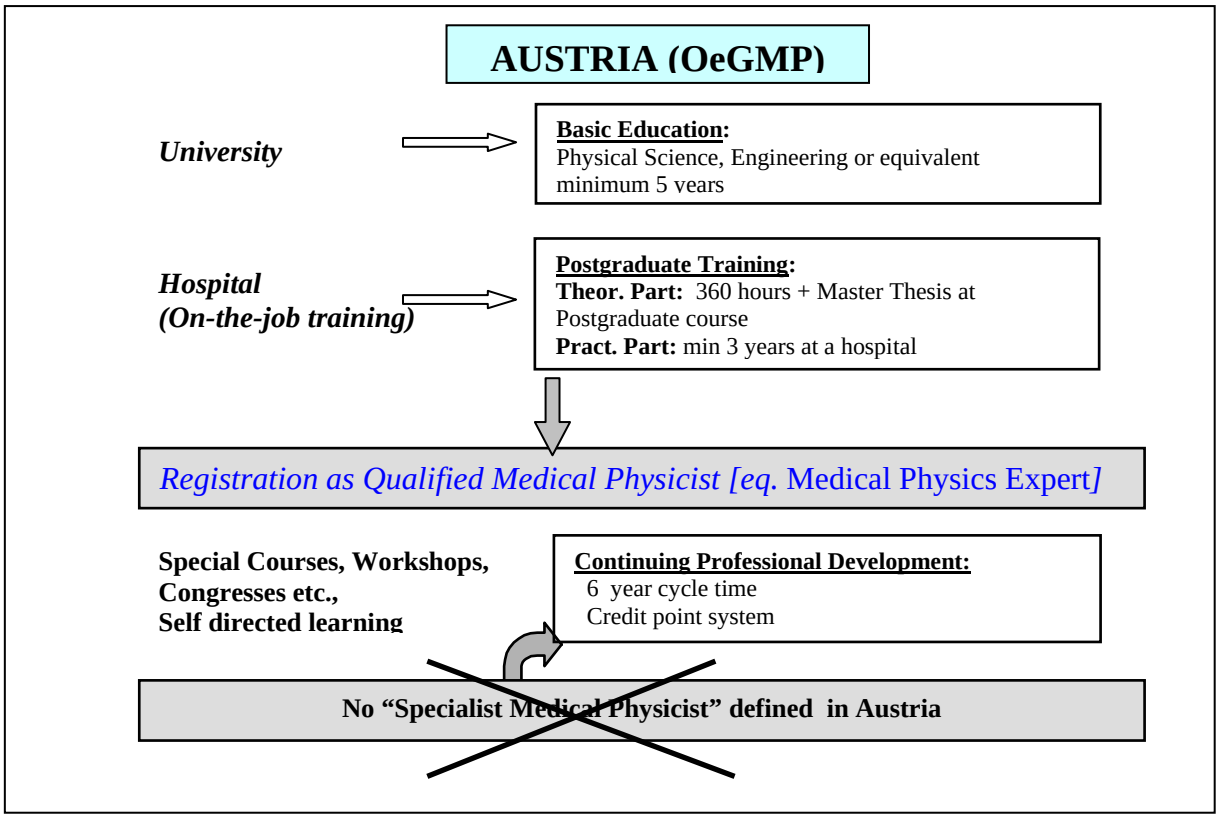
COUNTRY	General Information								Continuing Professional Development (CPD)			
	Register?	Officially recognised?	Who is in charge of it?	Volunt./ Compuls.	Haw many registrants?	Fraction of practising MP?	Proportion: Recognized scheme / not	Two levels : QMP/SMP?	Renewal mechanism?	Based on a CPD system?	Comply with PS N. 10?	CPD Cycle time
Austria	YES (2 differ.)	YES	OeGMP BMGF	Automat.	50	100%	20 / 30	NO	YES (both)	Partially	OeGMP: YES BMGF: NO	6 year
Belgium	YES (2 differ.)	FANC: Yes BHPA: No	FANC BHPA	Compuls. Voluntary	No data	No data	No data		YES (both)	YES (both)	Within the guidelines	6 year
Croatia	YES	NO	N/A	N/A	8	50%	No data	Not yet	N/A	YES	YES	N/A
Cyprus	NO											
Czech Republic	YES	YES	Ministry of Health	Compuls. (in 2006)	No data	No data	No data	NO	YES	YES	Not yet	N/A
Denmark	YES	NO	Educat. Committee of DSMF	Automat.	57 MP + 36 in training	100% in RT and NM	27 / 30	YES	YES, but not mandatory	YES	YES	
Finland	YES	YES	National Authority Medicolegal Affai.	Compuls.	80	100%	100%	NO	NOT yet	N/A	N/A	N/A
France	YES	NO	Registrat. Committ of SFPM	Voluntary	147	More than 50%	100%	YES	YES	YES	Fully	5 year
Germany	YES	NO	DGMP	Voluntary	550	Hospital MP only	80% / 20 %	NO	YES	YES	Fully	
Greece	YES	NO	HAMP	Voluntary	203	70 %	60% / 40%	NO	YES	YES	Fully	
Hungary	NO											
Italy	NO											
Latvia	YES	NO	Latvian Med Engin and Phys Society	Voluntary	30 (only 7 MP)	50%	100%	NO	NO	NO		
Netherlands	YES	YES	Executive Committ for Board Regist of the Dutch Society	Compuls.	245	Majority	Nearly all	NO	YES	YES	N/A	
Norway	NO											
Poland	YES	YES	CMKP and CEM + Ministry of Health	Voluntary	20 + 48 (in process)	20-30%	No data	NO	N/A	N/A		
Portugal	NO									NO formal		

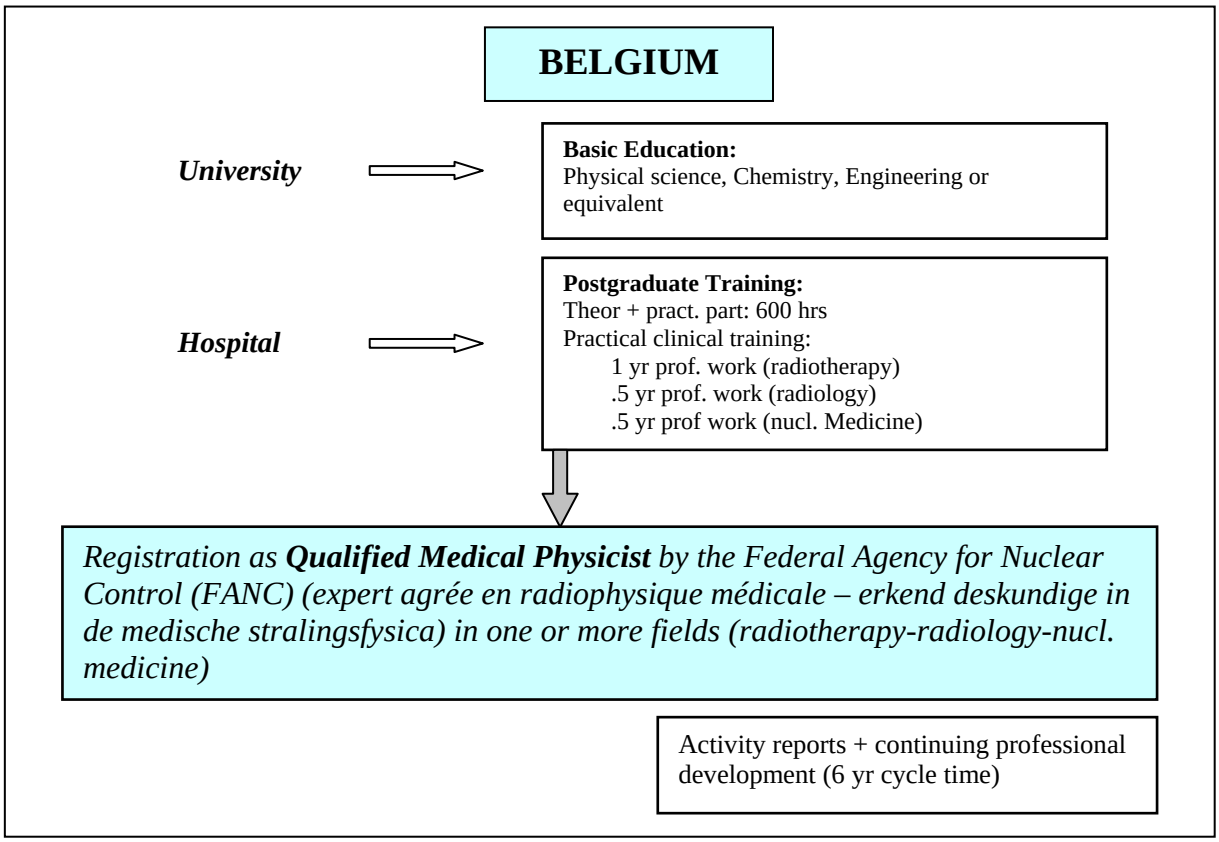
Russia	N/A											
Serbia-Montenegro	NO	Not yet	BIMEF + Minis. of Health and Labour	Compuls. (will be)	N/A	N/A	N/A	N/A	NO	NO		
Spain	YES (2 differ.)	1: YES 2: NO	1: Minis. of Health 2: SEFM	Automatic Voluntary	1: 480 2: 160	1: 100% 2: 33%	40% / 60%	1: NO 2: YES	1: NO 2: YES	1: NO 2: YES	2: Fully	5 year
Sweden	YES (2 differ.) ?	YES	National Body of Health and welfare	Compuls.	300	100%	10% / 90%	NO	YES(the CPD register) NOT (the official MP register)	YES	In process	
Turkey	NO	NO	N/A	N/A						NO		
U.K.	YES	YES	Health Professions Council	Compul.	1260	100 %	4:1	NO	YES	Will be	YES	

List of abbreviations used in this Table:

CPD: Continuous Professional Development
MP: Medical Physicist
QMP: Qualified Medical Physicist (EFOMP definition)
SMP: Specialist Medical Physicist (EFOMP definition)
PS: Policy Statement (EFOMP's document)
FANC: Federal Agency for Nuclear Control (Belgium)
OeGMP: Austrian Society for Medical Physics
BMGF: Ministry for Health and Women (Austria)
DSMF: Danish Society for Medical Physics
SFPM: French Society for Medical Physics
BHPA: Belgian Hospital Physicists Association
DGMP: German Society of Medical Physics
HAMP: Hellenic Association of Medical Physicists
CMKP: Medical Centre for Postgraduate Education (Poland)
CEM: Centre of Medical Examination (Poland)
BIMEF: Society of Biomedical Engineering and Medical Physics (Serbia-Montenegro)
SEFM: Spanish Society of Medical Physics

APPENDIX II: NMO's Education and Training Schemes





FINLAND

University ⇒ **Basic Education:** Physical Science, Engineering or equivalent, 5 years

Hospital (On-the-job training) ⇒ **Postgraduate Training:** **Theor. Part:** 40 weeks = 800 hours, licenciate work, hospital physicist examination

⇓

Registration as Qualified Medical Physicist

Special Courses, Workshops, Congresses etc., Self directed learning

Continuing Professional Development:
5 year cycle time
Credit point system

FRANCE

Prerequisite: L1L2L3 + M1 (4 years university) in physics or related areas
180 ECTS + 60 ECTS

⇓

M2 in medical physics (5th year university)
60 ECTS composed of a theoretical part and a research part

⇓

Diploma of Qualification in Radiological and Medical Physics (DQPRM)
7 weeks theoretical part and 32 weeks in accredited centers

=

MP Specialist
(as defined in the official text of 19/11/2004)

⇓

Doctorate in Medical Physics or related fields (Ph. D)

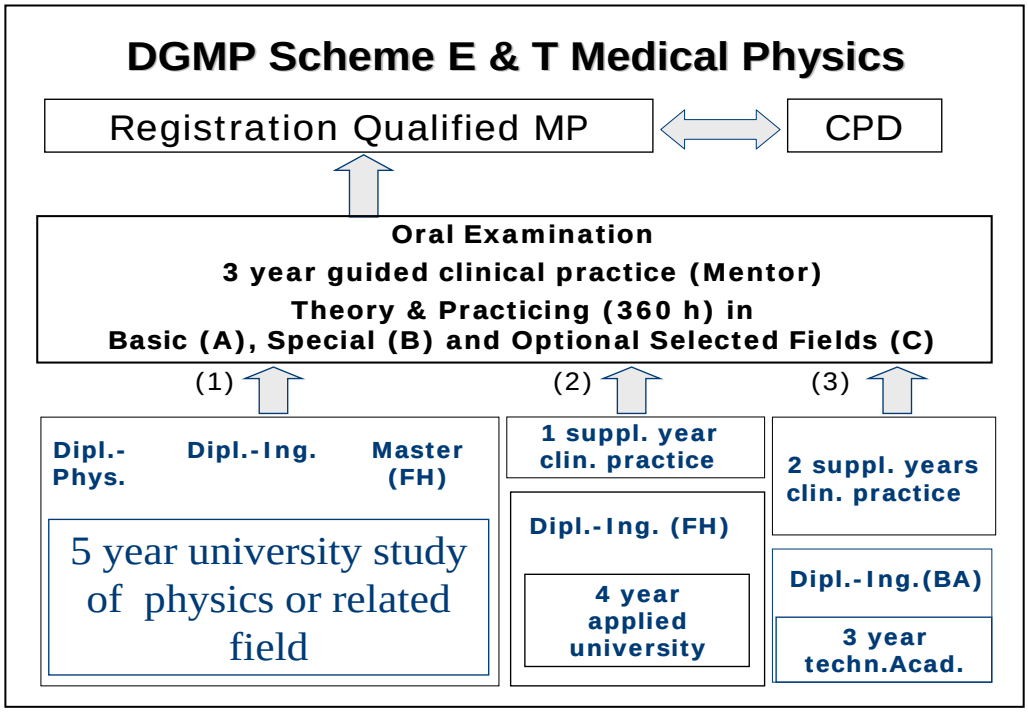
⇓

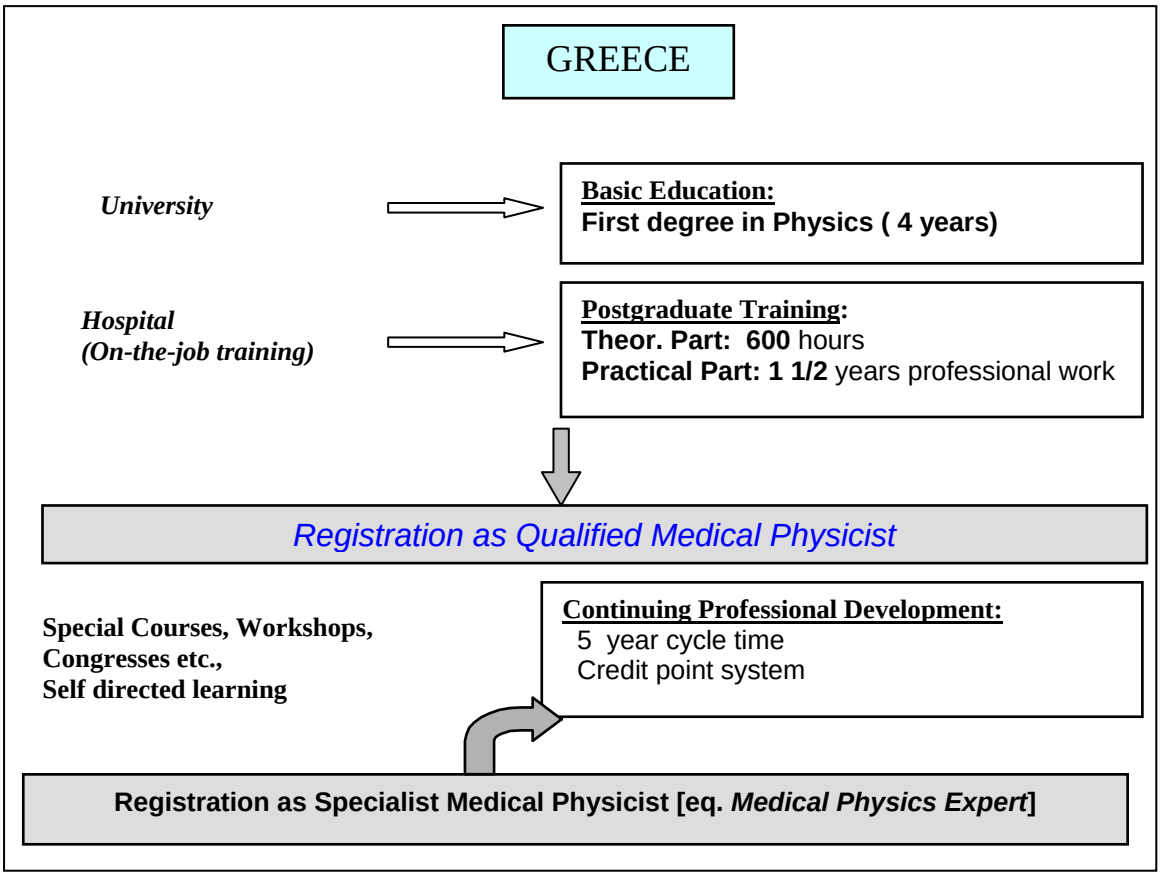
Registration on the SFPM Register (voluntary based)

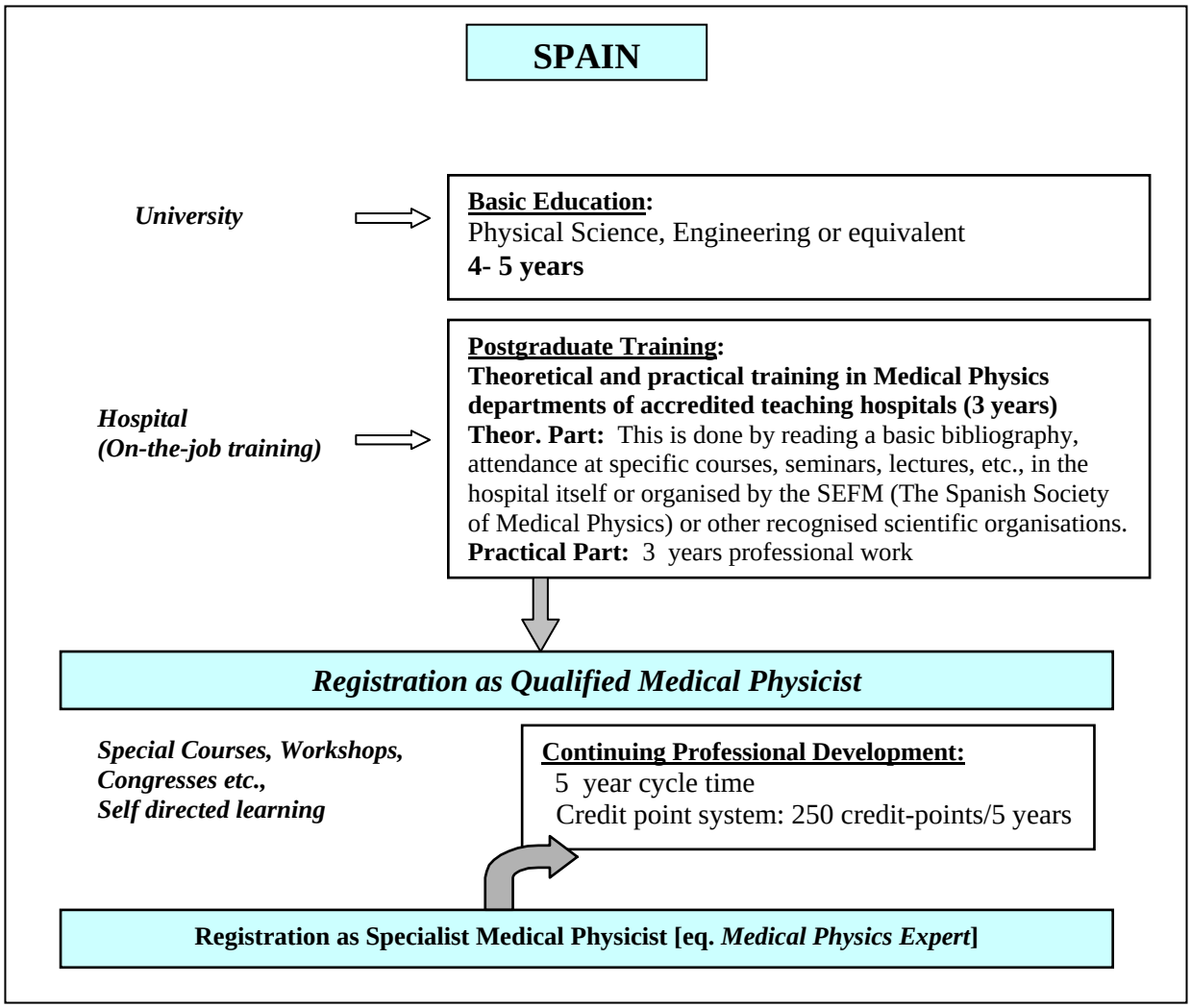
-as a Qualifed MP
if less than :
5 years experience
or
3 years when holding a PhD

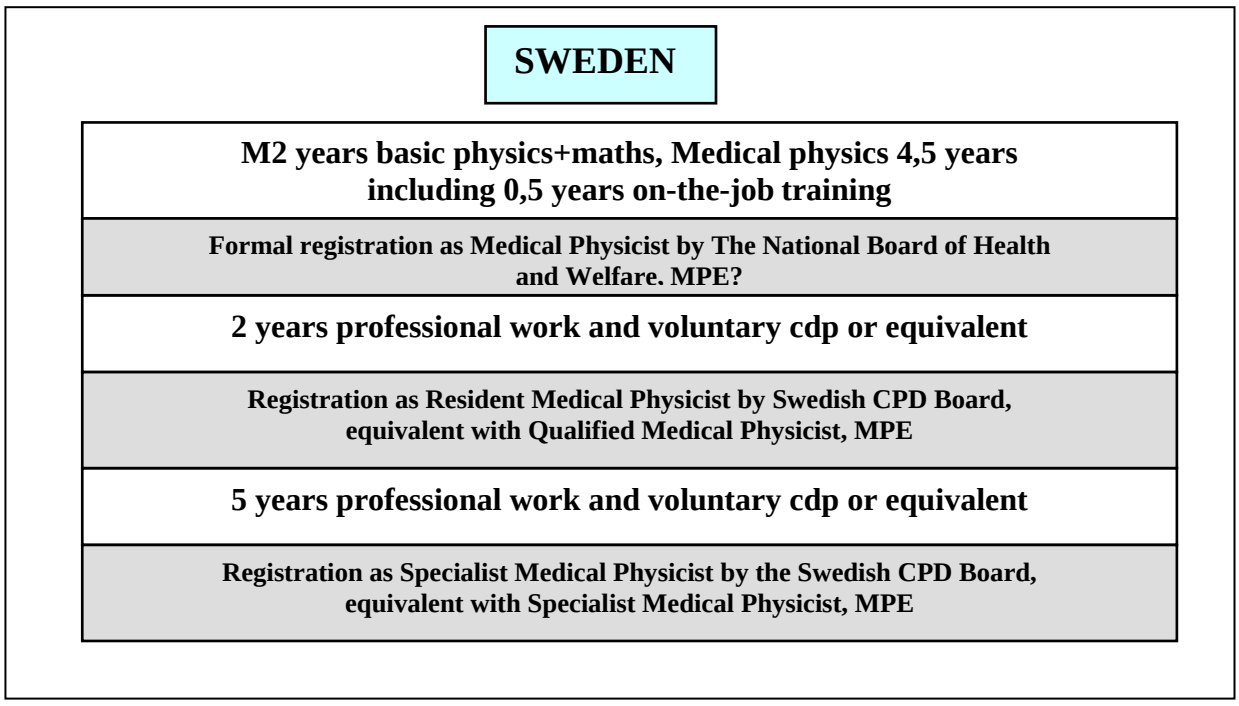
-as an Expert in Medical Physics

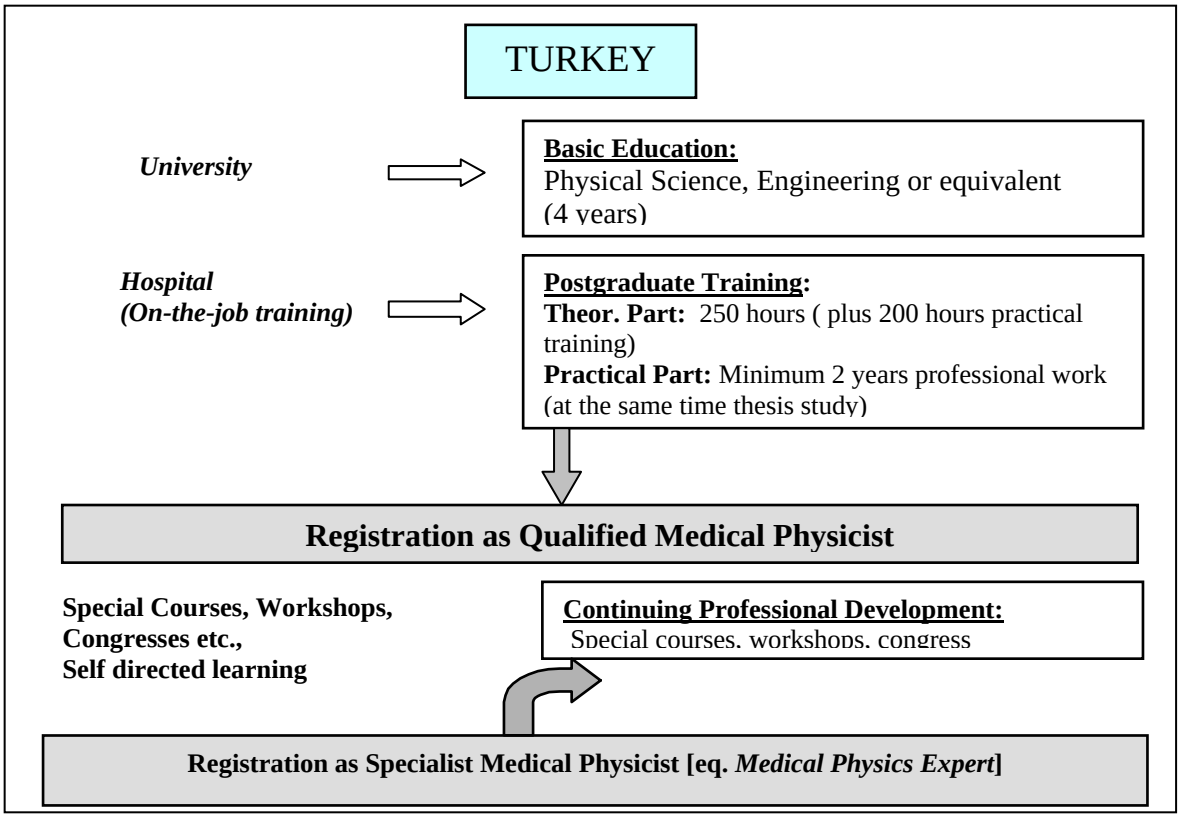
GERMANY

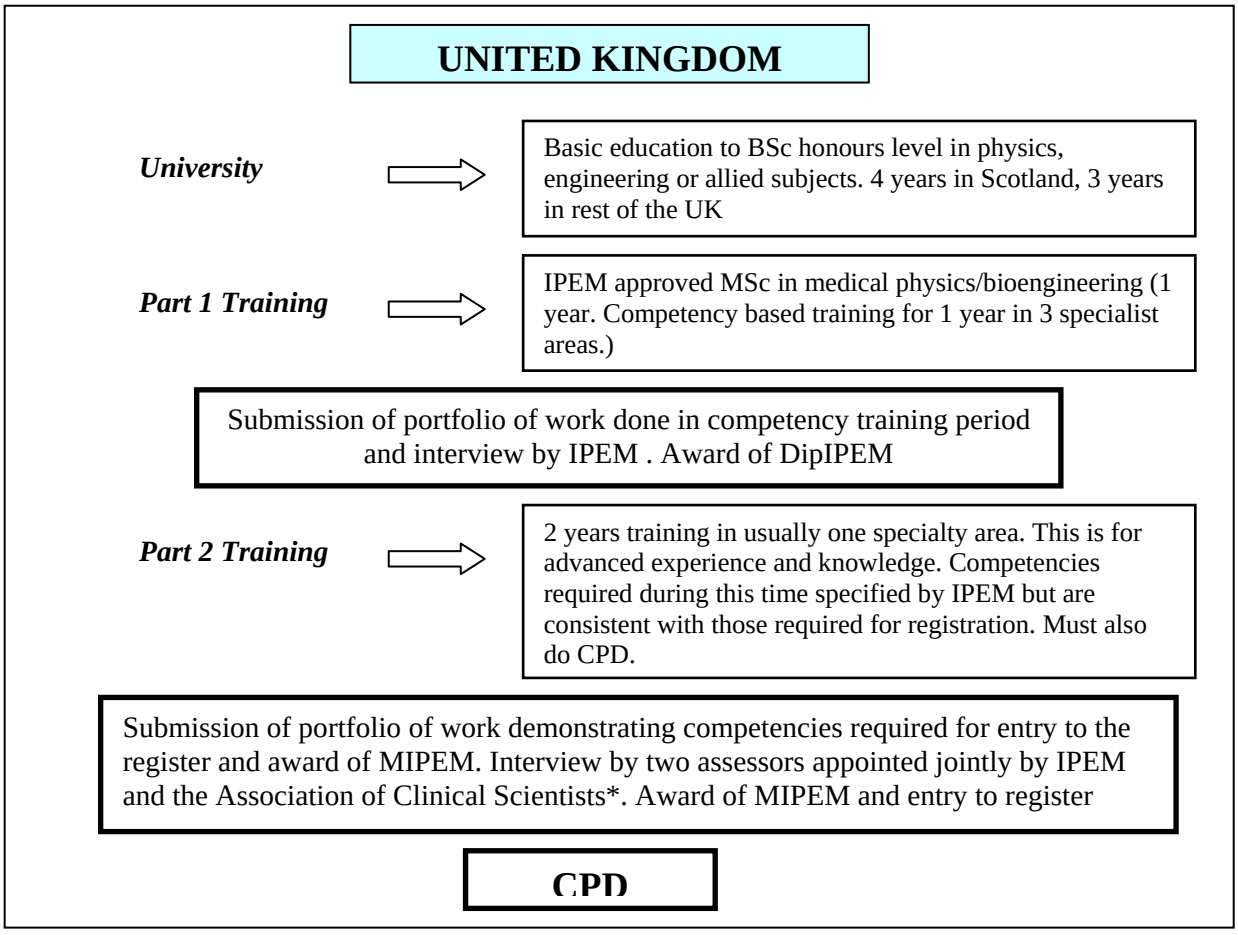

DGMP Scheme E & T Medical Physics
Registration Qualified MP
CPD
Oral Examination
3 year guided clinical practice (Mentor)
Theory & Practicing (360 h) in
Basic (A), Special (B) and Optional Selected Fields (C)
(1)
(2)
(3)
Dipl.-Phys.
Dipl.-Ing.
Master (FH)
5 year university study of physics or related field
1 suppl. year clin. practice
Dipl.-Ing. (FH)
4 year applied university
2 suppl. years clin. practice
Dipl.-Ing.(BA)
3 year techn.Acad.


GREECE
University
Basic Education:
First degree in Physics (4 years)
Hospital
(On-the-job training)
Postgraduate Training:
Theor. Part: 600 hours
Practical Part: 1 1/2 years professional work
Registration as Qualified Medical Physicist
Special Courses, Workshops,
Congresses etc.,
Self directed learning
Continuing Professional Development:
5 year cycle time
Credit point system
Registration as Specialist Medical Physicist [eq. Medical Physics Expert]


SPAIN
University
Basic Education:
Physical Science, Engineering or equivalent
4- 5 years
Hospital
(On-the-job training)
Postgraduate Training:
Theoretical and practical training in Medical Physics departments of accredited teaching hospitals (3 years)
Theor. Part: This is done by reading a basic bibliography, attendance at specific courses, seminars, lectures, etc., in the hospital itself or organised by the SEFM (The Spanish Society of Medical Physics) or other recognised scientific organisations.
Practical Part: 3 years professional work
Registration as Qualified Medical Physicist
Special Courses, Workshops, Congresses etc., Self directed learning
Continuing Professional Development:
5 year cycle time
Credit point system: 250 credit-points/5 years
Registration as Specialist Medical Physicist [eq. Medical Physics Expert]


SWEDEN
M2 years basic physics+maths, Medical physics 4,5 years including 0,5 years on-the-job training
Formal registration as Medical Physicist by The National Board of Health and Welfare. MPE?
2 years professional work and voluntary cdp or equivalent
Registration as Resident Medical Physicist by Swedish CPD Board, equivalent with Qualified Medical Physicist, MPE
5 years professional work and voluntary cdp or equivalent
Registration as Specialist Medical Physicist by the Swedish CPD Board, equivalent with Specialist Medical Physicist, MPE


TURKEY
University
Basic Education:
Physical Science, Engineering or equivalent
(4 years)
Hospital
(On-the-job training)
Postgraduate Training:
Theor. Part: 250 hours (plus 200 hours practical training)
Practical Part: Minimum 2 years professional work (at the same time thesis study)
Registration as Qualified Medical Physicist
Special Courses, Workshops, Congresses etc.,
Self directed learning
Continuing Professional Development:
Special courses, workshops, congress
Registration as Specialist Medical Physicist [eq. Medical Physics Expert]


UNITED KINGDOM
University
Basic education to BSc honours level in physics, engineering or allied subjects. 4 years in Scotland, 3 years in rest of the UK
Part 1 Training
IPEM approved MSc in medical physics/bioengineering (1 year. Competency based training for 1 year in 3 specialist areas.)
Submission of portfolio of work done in competency training period and interview by IPEM . Award of DipIPEM
Part 2 Training
2 years training in usually one specialty area. This is for advanced experience and knowledge. Competencies required during this time specified by IPEM but are consistent with those required for registration. Must also do CPD.
Submission of portfolio of work demonstrating competencies required for entry to the register and award of MIPEM. Interview by two assessors appointed jointly by IPEM and the Association of Clinical Scientists*. Award of MIPEM and entry to register
CPD