



Gli standard formativi in Europa e negli USA

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AIIC – Delegato per i rapporti internazionali



ROMA, 11-13 marzo



Bambino Gesù
OSPEDALE PEDIATRICO



Agenda

- Geographic & statistic data EU
- EU education approach and projects
- AIIC 2010 survey on CE in EU

- USA: ACCE certification

- Conclusion and questions





European Union 1995-2003



15 Members





European population in 2000

Country	Inhabitants (millions)	Inhabitants (per cent)
Germany	82	22%
France	59	16%
United Kingdom	59	16%
Italy	57	15%
Spain	40	11%
Netherlands	16	4%
Greece	11	3%
Portugal	10	3%
Belgium	10	3%
Sweden	9	2%
Austria	8	2%
Denmark	5	1%
Finland	5	1%
Ireland	4	1%
Luxembourg	0,5	<1%



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European Union 2004-2006



25 Members





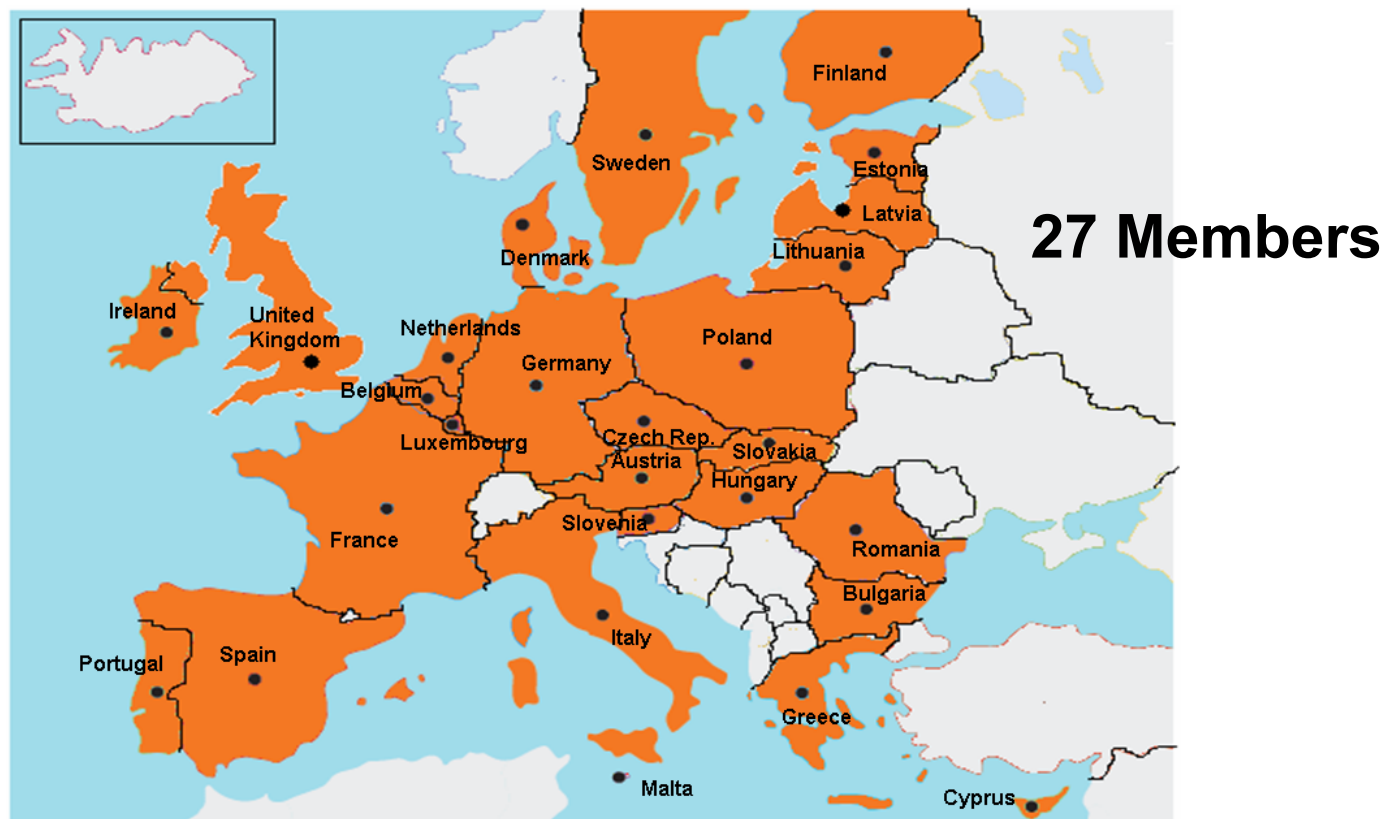
European population in 2004

Country	Inhabitants (millions)	Inhabitants (per cent)	Country	Inhabitant (millions)	Inhabitants (per cent)
Germany	82	18%	Sweden	9	2%
France	61	13%	Austria	8	2%
United Kingdom	60	13%	Denmark	5	1%
Italy	58	13%	Slovak Republic	5	1%
Spain	43	9%	Finland	5	1%
Poland	38	8%	Ireland	4	1%
Netherlands	16	4%	Lithuania	3	1%
Greece	11	2%	Latvia	2	<1%
Portugal	10	2%	Slovenia	2	<1%
Belgium	10	2%	Estonia	1	<1%
Czech Republic	10	2%	Cyprus	0,5	<1%
Hungary	10	2%	Luxembourg	0,5	<1%





European Union 2007-2010





European Union today





European population in 2008

Country	Inhabitants (millions)	Inhabitants (per cent)	Country	Inhabitants (millions)	Inhabitants (per cent)
Germany	82	14%	Sweden	9	2%
France	62	11%	Austria	8	1%
United Kingdom	61	11%	Bulgaria	7	1%
Italy	59	10%	Denmark	5	1%
Spain	46	8%	Slovak Republic	5	1%
Poland	38	7%	Finland	5	1%
Romania	22	4%	Ireland	4	1%
Netherlands	16	3%	Lithuania	3	1%
Greece	11	2%	Latvia	2	<1%
Belgium	11	2%	Slovenia	2	<1%
Portugal	10	2%	Estonia	1	<1%
Czech Republic	10	2%	Cyprus	1	<1%
Hungary	10	2%	Luxembourg	0,5	<1%

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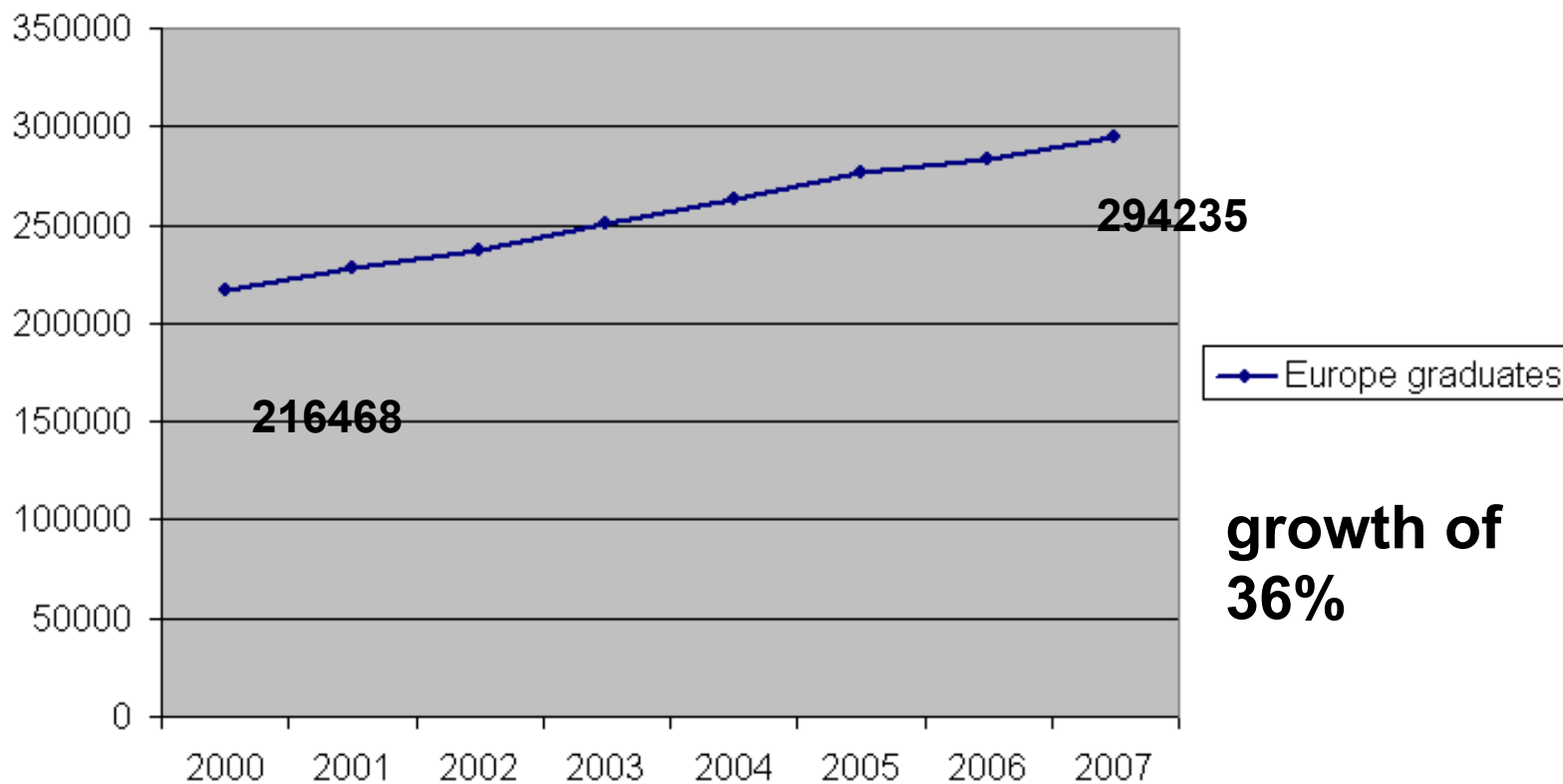
Others Countries – Population in 2008

	Country	Inhabitants (millions)
EU Candidate	Turkey	11
	Croatia	5
	Macedonia	2
Others	Switzerland	8
	Norway	5
	Iceland	0,5





Graduates number in Engineering Area



source OCSE





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European problem

Confusing regulations about competencies and admissibility of central action regarding education



Solutions:

- 1997 Amsterdam treaties clarify which activities of European Commission in the area of education are allowed in co-operation with the member states
- Treaties emphasize european dimension of education leaving full responsibility for the structuring of educational system with the individual states
- Responsibility of the Union is to support and supplement activities of the member states





European Higher Education Area

Bologna Declaration, June 1999

Request to establish a European Area of Higher Education by 2010 and to:

- adopt a system of easily readable and comparable degrees
- adopt a system with 2 main cycles
- establish a system of credits (ECTS)
- promote mobility by overcoming obstacles
- promote European co-operation in quality assurance
- promote European dimensions in higher education



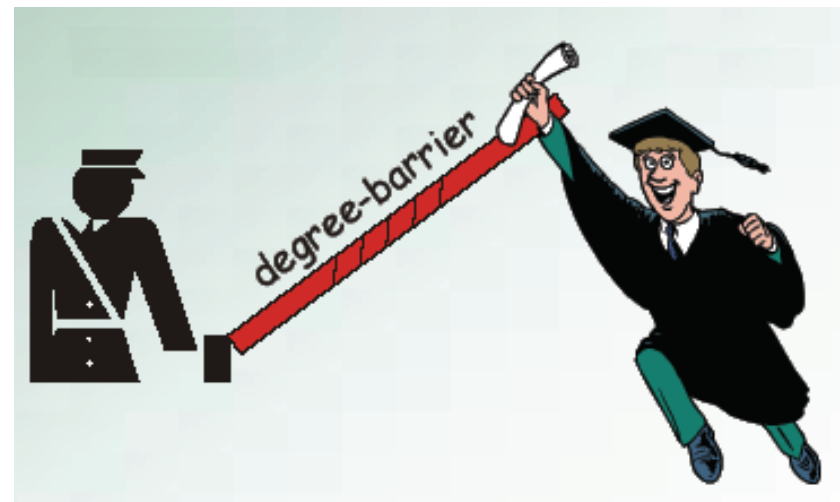


European Higher Education Area

Implementation of the European Higher Education Area requires structures and procedures as well as instruments warranting the transparency and mutual recognition of qualification

One of the major obstacles for people wishing to work or to study in a European country is that their qualifications and competences may not be accepted.

To remove these obstacles, the EU has introduced several instruments, aiming at facilitating the transfer of qualifications and competences for academic and professional purpose.





European Higher Education Area

Transparency and Recognition for Academic Purposes

The network of *National Academic Recognition Information Centres* (NARICs), created at the Commission's initiative in 1984, covers all EU and European Economic Area Member States and all the associated countries in Central and Eastern Europe. These centres provide authoritative advice and information on the *academic recognition of diplomas and periods of study undertaken*

The *European Credit Transfer System* was introduced by the Commission more than 10 years ago as a common basis for recognizing students' study period abroad





European Higher Education Area

Realizing the requests for *employability, mobility, compatibility, and quality assurance* requires European agreement on:

- ❖ ***Accreditation of educational programs***
- ❖ ***Training***
- ❖ ***Continuing education***
- ❖ ***Certification of individuals***
- ❖ ***Regulation of professions***





BIOMEDEA

BIOMEDEA is a Europe-wide participation project contributing to the realization of the European Higher Education Area (*Bologna Process*)

- The objective of the project is to establish consensus on European guidelines for the harmonization of Medical and Biological Engineering programmes, their accreditation and for certification and continuing education of professionals working in the health care systems
- Adherence to these guidelines will insure mobility in education and employment as well as the necessary safety for patients
- Target for the dissemination of results will be the European universities, political decision makers, accreditation agencies, health care providers and students
- Three meetings (Eindhoven on December 2004, Warsaw on March 2005, **Stuttgart on September 2005**)





Quality Assurance

As a response to the objectives of the Bologna Declaration, the

European Network for Quality Assurance in Higher Education (ENQA)

was established. Since 1999, ENQA has supplied information about proven practical experiences as well as the newest approaches and discussions in the field of quality assessment and quality assurance.





Clinical/Biomedical engineering

Biomedical Engineers design, develop, use and manage instrumentation for patient monitoring, diagnosis, treatment or research



Clinical Engineers are **Biomedical Engineers** based in clinical environment, usually a hospital or rehabilitation unit. They may be responsible for the design, **management and quality assurance** of patient-connected equipment in hospitals





Not only Biomedical Engineers

Today, Clinical Engineers are also:

- Electronic Engineers
- Informatic Engineers
- Mechanical Engineers

with

- specialization in biomedical area
- work experience in clinical engineering





Subject-Based Accreditation

- There is an urgent need for subject-based accreditation and evaluation at the European level, a type of evaluation that is not based on national systems or institutions, but on subject areas, disciplines or professions.
- A missing element in Europe is that institutions do not have independent European bodies to which they could turn for an evaluation of their curricula that would not be biased by national interests





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- Geographic & statistic data EU
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Our survey

- Information relating to education of biomedical/clinical engineers were asked to European Associations with a specific question form.
- The information asked relates to:
 - existence of National Associations of Clinical Engineering with respective number of members
 - presence, description and duration of the first and second cycles of biomedical engineering university education
 - presence, description and duration of doctoral studies or specialistic master in clinical engineering
 - List of universities offering biomedical engineering courses (Bachelor, Master, PhD)





Survey form

Part 1

General information	
Country	Italy
National Association of Clinical and Biomedical Engineers 1. *	Italian Association of Clinical Engineers (Associazione Italiana Ingegneri Clinici, AIIC)
	Founded on
	Membership number
	Reference President: <u>Pietro Derrico</u> , PhD Address: Country: ITALY Tel.: Fax: E-mail: Web:
National Association of Clinical and Biomedical Engineers 2.	Founded on
	Membership number
	Reference President: Address: Country: Tel.: Fax: E-mail: Web:
	Reference President: Address: Country: Tel.: Fax: E-mail: Web:
National Association of Clinical and Biomedical Engineers 3.	Founded on
	Membership number
	Reference President: Address: Country: Tel.: Fax: E-mail: Web:
	Reference President: Address: Country: Tel.: Fax: E-mail: Web:

*If more than one, please fill in the spaces below

Part 2

Biomedical Engineering Education	
First Cycle degree Program in Biomedical Engineering or Bachelor degree	Three-Years Degree in Biomedical Engineering
	Duration 3 years (180 ECTS)
	Universities Ancona, Bologna, Genova, Pavia...
Second Cycle degree Program in Biomedical Engineering or Master degree	Specialistic Degree in Biomedical Engineering:
	Duration 2 years (120 ECTS)
	Universities
Doctoral studies (PhD)	Bioengineering PhD, Bioinformatics PhD, Bioelectronics PhD.
	Duration 3 years (180 ECTS)
	Universities
Masters Courses or Post-graduate Courses	Specialistic Master in Clinical Engineering
	Duration 1 years (60 ECTS)
	Universities Trieste, Bologna, Firenze
Biomedical Education topics in other degrees	Electronic Engineering, Informatic Engineering, Mechanic Engineering
Accreditation of degrees and programs	In line with Italian law ...

The information was required to all european association





European Association

- GERMANY:** German Association of Biomedical Engineering
- GERMANY:** Fraunhofer Institute for Biomedical Engineering
- FRANCE:** French Association of Biomedical Engineers
- FRANCE:** French Association of Medical and Biological Engineering
- UNITED KINGDOM:** The Institute of Physics and Engineering in Medicine
- ITALY:** Italian Association of Clinical Engineering
- ITALY:** Italian Association of Medical and Biological Engineering
- SPAIN:** Sociedad Espanola de Electromedicina e Ingegneria Clinica
- SPAIN:** Spanish Society of Biomedical Engineering
- POLAND:** Polish Scientific and Technical Committee for Biomedical Engineering of SEP
- POLAND:** Polish Society for Biomedical Engineering
- ROMANIA:** National Society of Medical Engineering and Biological Engineering
- NETHERLANDS:** The Netherlands Society for Biophysics and Biomedical Technology
- GREECE:** Hellenic Society of Biomedical Technology
- PORTUGAL:** Sociedade Portuguesa de Egenharia Biomedica

IFMBE affiliated	Have responded
x	x
	x
	x
x	
x	
x	
x	
x	
x	
x	x
x	





European Association

BELGIUM: Belgian Society for Medical and Biological Engineering and Computing

CZECH REP.: Czech Society for Biomedical Engineering and Medical Informatics

HUNGARY: Hungarian Clinical Engineering Society

SWEDEN: Swedish Society for Medical Engineering and Medical Physics

AUSTRIA: Austrian Society for Biomedical Engineering

BULGARIA: Bulgarian National Society of Biomedical Physics and Engineering

DENMARK: Danish Society for Biomedical Engineering

SLOVAK REP.: Slovak Society of Biomedical Engineering and Medical Informatics

FINLAND: Finnish Society for Medical Physics and Medical Engineering

IRELAND: Biomedical Clinical Engineering Association of Ireland

LITHUANIA: Lithuanian Society for Biomedical Engineering

LATVIA: Latvian Medical Engineering and Physics Society

SLOVENIA: Slovenian Society for Medical and Biological Engineering

ESTONIA: Estonian Society for Biomedical Engineering and Medical Physics

CYPRUS: Cyprus Association of Medical Physics and Biomedical Engineering

IFMBE affiliated	Have responded
x	
x	
x	
x	x
x	
x	
x	
x	x
x	x
	x
x	
x	
x	





European Association

Candidate countries for EU accession and other countries

CROATIA: Croatian Medical and Biological Engineering Society and Computing

NORWAY: Norwegian Society for Biomedical Engineering

SWITZERLAND: Swiss Society of Biomedical Engineering

UKRAINE: Institute of Medical Engineering and Clinics

ICELAND: Icelandic Society for Biomedical Engineering

SERBIA-MONTENEGRO: Society of Biomedical Engineering and Medical Physics of Serbia and Montenegro

IFMBE affiliated	Have responded
x	x
x	
x	x
	x
x	
x	





Survey response

- Today, have responded:
 - Germany
 - France
 - Ireland
 - Finland
 - Austria
 - Greece
 - Croatia
 - Ukraine
 - Lithuania
 - Switzerland

MORE THAN 40% in POPULATION... and we will continue to collect information





Present situation – Survey results

Models:

- 180 credits Bachelor + 120 credits Master;
- 240 credits Bachelor + 90 to 120 credits Master (up to 30 or 60 credits may be waived in view of previous relevant studies during the final Bachelor year);
- 300 credits Master (integrated programmes).





Present situation – Survey results

In spite of significant variety regarding duration and architecture of programmes, there is a dominant trend towards Master level degrees that require the equivalent of 300 ECTS credits, ...

... as an IFMBE and EAMBES recommendation, these should contain at least 60 credits at the graduate level in the area of specialization, i.e. Medical and Biological Engineering and Science





Present situation – Survey results

Regional differences in the realization of the Bologna Process:

- countries with Anglo-Saxon tradition have difficulties to change and harmonize their systems;
 - the Baltic and Nordic countries are well advanced in the reform process;
 - in Western and Southern Europe, the Bologna Process is boosting reforms;
 - in Central and Eastern Europe, the reforms continue and gain speed after some initial resistance to change
- Regional differences in the realization of the Bologna





Implementation of the Declaration

First cycle courses:

- minimum three-years of the first cycle is becoming the standard;
- stand alone courses leading to technical/ technician level qualification;
- first stage to a two-cycle degree.

Two models:

- BME is a component of a mixed degree;
- Degree are nominal in BME.





Implementation of the Declaration

Second cycle with a variable structure

Three common models:

- the second cycle follows the first cycle as an integrated course leading to a single degree;
- a wholly BME postgraduate Masters degree, with the completion of a first cycle degree as an essential entry;
- instead of going through a third circle, some countries offer a doctoral degree instead of a Master degree as the outcome of the second





Implementation of the Declaration

Third cycle BME degrees:

- Doctoral study (**PhD**) is traditionally rather like a research apprenticeship, almost entirely research based (minimum duration is three years);
- post-graduate program of 1 year based on topics as clinical engineering, health technology assessment and risk management (**Specialistic Master in Clinical Engineering**).





International Harmonization

IFMBE is providing its European national member societies, the European universities and other institutions of higher education which offer BME programs a uniform guide to comply with the necessary international harmonization of higher education

- to secure and to improve the high quality of European BME education
- to allow comparability of European BME qualifications and degrees
- to contribute to mobility for education, training and employment
- to promote European competitiveness in a dynamic discipline as biomedical engineering





Importance of a Protocol

- Improve the standards of healthcare delivery establishing common professional standards of practice
- Facilitate the exchange of personnel between and within European countries
- Provide an accepted reference for government and international and international agencies regarding staffing
- Improve collaboration by stimulating dialogue
- Increase the understanding of education and training systems for clinical engineers in different countries





Implementation of the Declaration

Who will implement the European Higher Education Area, and how will it be done?

In addition to the current players in the Bologna Process, **the scientific and professional societies must become active, and take the leading developments related to their fields.**

IFMBE, EAMBES, the national and trans-European Biomedical Engineering Societies





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- **USA: situation, ACCE, certification**

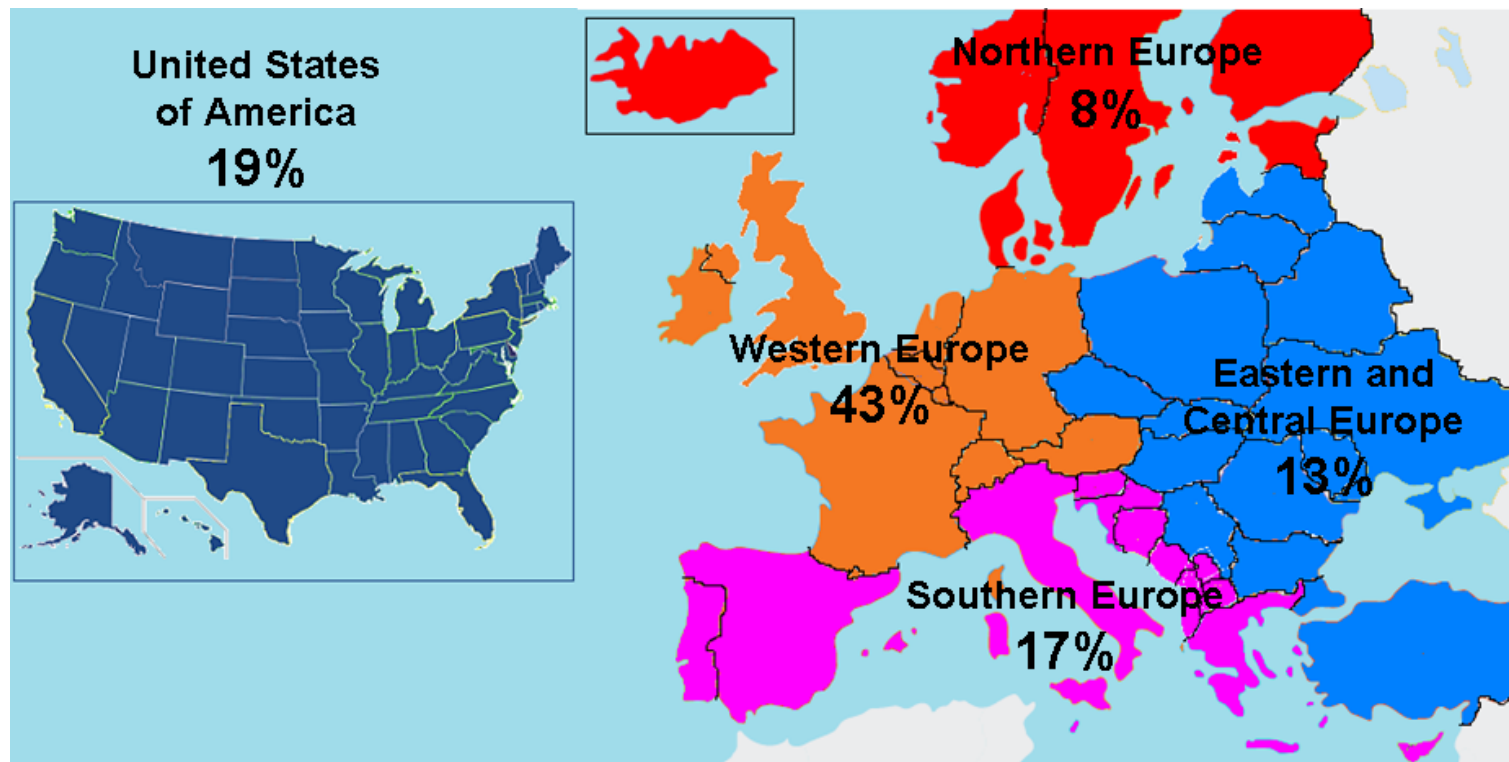
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Where to study - Survey results

Universities distribution where Biomedical/Clinical Engineering programmes are offered





Where to study in USA

Many american universities offer biomedical/clinical engineering programmes

- Arizona State University
- Boston University
- Brown University
- California State University, Long Beach
- Case Western Reserve University
- Duke University
- Harvard University
- Johns Hopkins University
- Louisiana Tech University
- Marquette University
- Massachusetts Institute of Technology
- Mercer University
- Michigan Technological University
- Milwaukee School of Engineering
- Montana State University-Bozeman
- New York Institute of Technology
- North Western University
- Old Dominion University
- Oral Roberts University
- Pace University
- University of Washington
- Georgia Institute of Technology
- University of Pennsylvania
- University of California–Berkeley
- Rice University
- Stanford University
- University of Utah
- University of Virginia
- University of Connecticut
- Rensselaer Polytechnic Institute (NY)
- Washington University in St. Louis
- Columbia University
- University of Texas–Austin
- Purdue University
- Rutgers, State University of New Jersey
- Catholic University of America
- University of Iowa
- Tulane University
- University of Hartford
- University of Tennessee, Knoxville





Clinical Engineers in USA

- **Clinical engineering education** is based in classical engineering, supplemented with a combination of courses in physiology, human factors, systems analysis, medical terminology, measurement, and instrumentation.
- It is often **completed with an internship** in a university hospital setting, giving the student a firm grounding in hospital operations, protocols, and ethics.
- All of this background prepares the clinical engineer to fill a **variety of roles** in research, design, academia, and most often, the clinical environment.

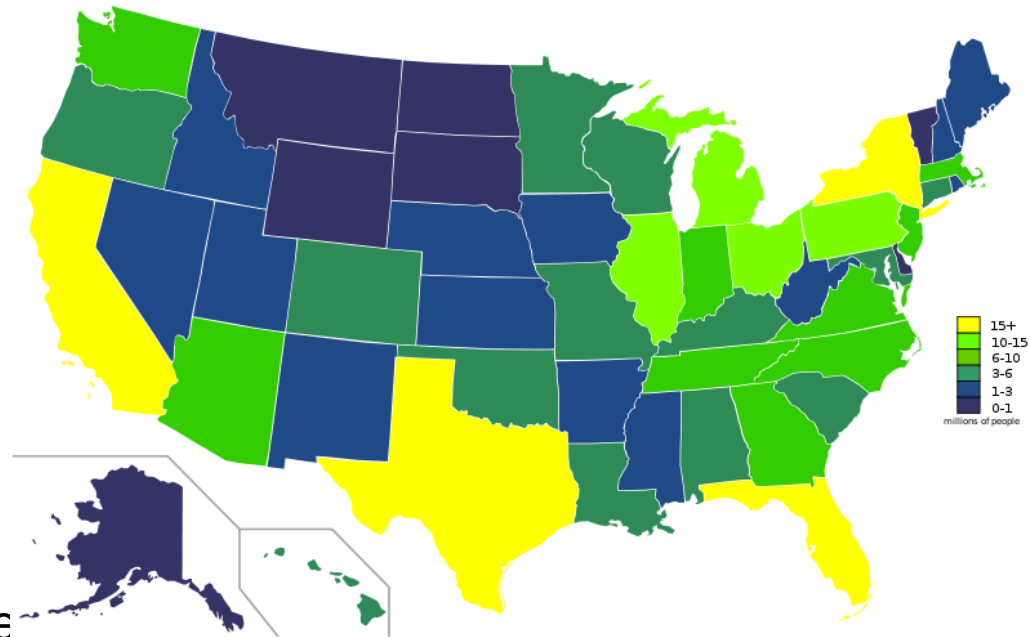




American College of Clinical Engineering ACCE

ACCE Mission:

- To establish a standard of competence and to promote excellence in clinical engineering practice
- To promote safe and effective application of science and technology in patient care
- To define the body of knowledge on which the profession is based
- To represent the professional interest of clinical engineers





ACCE – Eligibility Requirements

One of these is required:

- PE License + 3 years of CE practice
- BS Eng + 4 years of eng practice with 3 years of CE practice
- BS in Science or Math + 6 years of eng practice with 3 years of CE practice
- BSET + 8 years eng practice with 3 years of CE practice
- None of above + 10 years eng practice with 3 years of CE practice





ACCE – Exam Process for Certification

- Structured to match “Clinical Engineering Body of Knowledge”
- Written exam (administered by testing agency)
- Oral exam (administered by Board of Examiners)
- **Certification** valid for 3 years
- Renewal required





ACCE – Program Goals

- To become fully accepted by the Clinical Engineering community
- To remain financially self-sufficient
- To change the exam content as the body of knowledge changes
- To require evidence of continuing practice to retain certification





Conclusion

Keeping in mind that in addition to the Bologna process, innovative teaching strategies and methods as well as new educational programmes, filling the gap between engineering and life sciences with a variety of new specializations, are emerging throughout Europe

**The goal is the profession of Clinical Engineer
Toward a European College of Clinical Engineers?**

In USA, ACCE Certification program is evidence of a maturing and established profession

**Extension of this model to Europe
with the IFMBE-CED?**





Next european meeting

MEDICON 27-30 MAY 2010

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Dott. Ing. Gianluca Zarola for the presentation





Grazie per l'attenzione

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