



# THE BIOMEDEA PROJECT

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# BIOMEDICAL ENGINEERING EDUCATION

## The US Approach:

- Homogeneous higher education system,
- Universities are in full control of the higher education system,
- Whitaker grants for new BME programmes and research,
- Whitaker Summits on BME education (new methods, best practices, contents),
- ABET for quality assurance, accreditation,
- ACCE for clinical engineering certification.

## The European Approach:

- Huge diversity of higher education systems,
- Higher education systems controlled by the governments,
- A European Project (BIOMEDEA) co-sponsored by IFMBE and a number of universities, endorsed by EAMBES, preparing BME education for the harmonized European Higher Education Area (EHEA).

# *EUROPEAN STRUCTURES OF EDUCATION, RESEARCH, AND RESEARCH FUNDING*

*Traditionally, strictly national*



*Unifying and harmonizing Europe*



*European structures*

*A single European system or compatible, harmonized national systems?*

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

*How will BME education and research change through these developments?*

*What are the consequences for human resources and technical advancement in the field of BioMedical Engineering?*

*How can the community of biomedical engineers influence the developments?*

## *EU 1992 Maastricht and 1997 Amsterdam Treaties*

### *Problem:*

*Confusing regulations about competencies and admissibility of central actions regarding education.*

### *Solution:*

- *Treaties clarify which activities of the European Commission in the area of education are allowed in co-operation with the member states.*
- *Treaties emphasize the European dimension of education.*
- *Treaties insist on subsidiary, leaving full and unrestricted responsibility for the structuring of educational systems and curricula with the individual member states.*
- *Responsibility of the Union is to support and supplement activities of the member states.*
- *No harmonization of national laws and administrative procedures by unilateral decisions of any European bodies.*

# ***THE BOLOGNA PROCESS***

***THE BOLOGNA SIGNATORY COUNTRIES:***

***the harmonized European Higher Education Area (EHEA).***

***Mobility***

***THE EUROPEAN COUNCIL:***

## ***EUROPE OF KNOWLEDGE***

***the harmonized European Education and Research Area, a most competitive and dynamic, knowledge based economic union.***

*Important meetings and declarations towards the creation  
of the European Higher Education Area:*

*Sorbonne 1998*

*Bologna 1999*

*Salamanca 2001*

*Prague 2001*

*Berlin 2003*

*Bergen 2005*

## *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 two main cycles (undergraduate/graduate),*
- *establish a system of credits (such as ECTS)*
- *promote mobility by overcoming obstacles*
- *promote European co-operation in quality assurance*
- *promote European dimensions in higher education.*

## *Berlin Meeting, 2003*

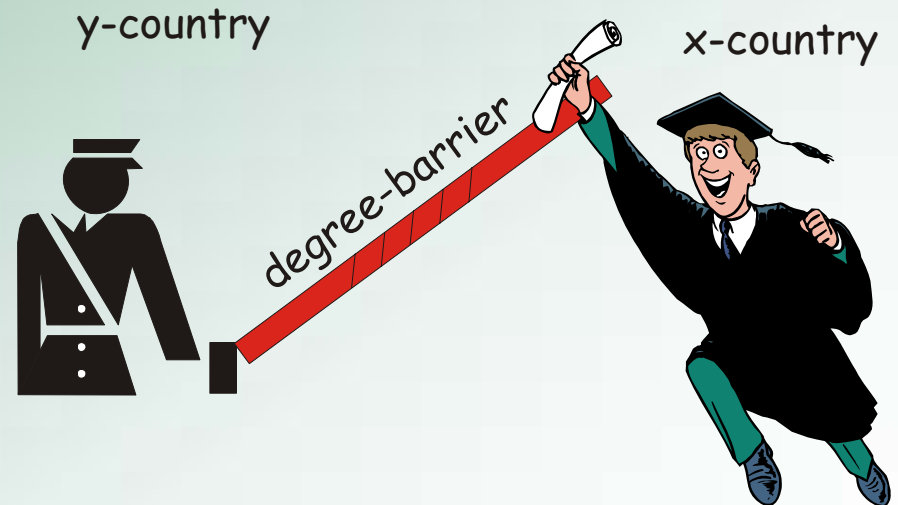
### *Participants:*

- *National governmental delegations of the signatory countries of the Bologna Declaration (40 countries)*
- *Representation of European higher education – Presidents of the Rectors' Conferences of the signatory countries of the Bologna Declaration and distinguished experts nominated by EUA*
- *Students' representation – nominated by the platform of European student organizations (ESIB, ESN, AEGEE)*
- *Representatives of the European Commission, Council of Europe, UNESCO, OECD, NARIC, ENIC, EURASHE*
- *Observers from non-signatory countries, that expressed their interest in the process*

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

*One of the major obstacles for people wishing to work or to study in a European country other than their home 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 purposes.*



## *Implementation of the European Higher Education: The Instruments*

### *The European Area of Lifelong Learning*

*shall enable people to meet the challenges of the knowledge-based society by promoting the development of their knowledge and competences at all stages of their lives.*

*The validation of 'non-formal learning' is a crucial element of lifelong learning, enabling people to build on knowledge and skills wherever they are acquired.*

## *Implementation of the European Higher Education: The Instruments*

### *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 abroad.***

*A parallel network, **ENICs**, was set up by the Council of Europe and UNESCO-CEPES.*

*The joint NARIC-ENIC network covers a broad framework of countries.*

## *Implementation of the European Higher Education: The Instruments*

### *Transparency and Recognition for Academic Purposes*

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

*The Commission, the Council of Europe and UNESCO have jointly developed a **Diploma Supplement** which includes both a graduate's personal achievements and a description of his or her national higher education system.*

## *Implementation of the European Higher Education: The Instruments*

### *Instruments for Professional Recognition in Regulated Professions*

*Professional recognition in the regulated professions is covered by a set of directives specifying the rights of individual citizens in the field of qualifications. This set of directives will in the near future be replaced by one single directive covering all regulated professions.*

*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*

## *Quality Assurance*

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

### *European Network for Quality Assurance in Higher Education (ENQA)*

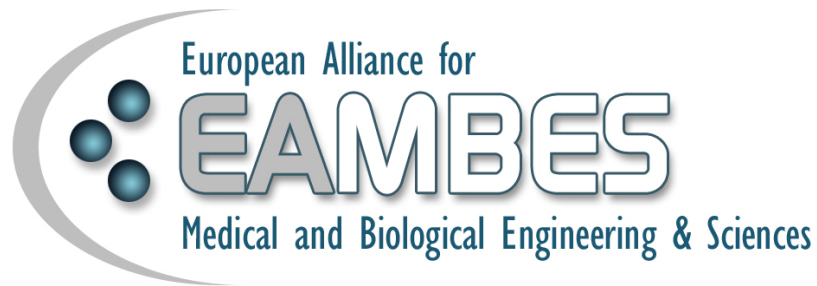
*was established. Since 1999, ENQA has supplied information about proven practical experiences as well as the newest approaches and discussions in the field of quality assessment and quality assurance.*

## *Subject-Based Accreditation and Evaluation at the European Level*

*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.*

***EUROPEAN BME.NET***



*<http://www.eambes.org>*



*<http://www.ifmbe.org>*

## *Present situation and expectations for the future*

### *General Impact of EHEA I*

*Survey on Master and Joint Degrees in Europe shows:*

*the development of the two-cycle programmes (Bachelor and Master) has no systematic negative effects on the quality of education, adding the advantages of harmonized or even international programmes, the European educational systems will gain in quality and international competitiveness.*

## *Present situation and expectations for the future*

### *General Impact of EHEA II*

*A survey on Master and Joint Degrees in Europe shows:*

*in spite of significant variety with regard to 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 and expectations for the future*

### *Possible 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 and expectations for the future*

### *Regional differences in the realization of the Bologna Process*

- *countries with Anglo-Saxon tradition are less eager to change and harmonize their systems*
- *the Baltic countries are well advanced in the reform process*
- *the Nordic countries are deepening the reform*
- *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*

## *Present situation and expectations for the future*

### *Expectations of the university faculty members:*

- *increasing importance of continuing education (life-long learning),*
- *development of new professional profiles,*
- *administration will become more complicated,*
- *higher education will be easier to plan,*
- *academic programmes will offer less freedom on how to study, course-work will be stronger regulated (more like secondary schools),*
- *academic programmes will become more transparent,*
- *the universities will become more attractive for foreign students,*
- *the graduates will have better opportunities in a global economy.*

## *Present situation and expectations for the future*

### *Survey specific to MBES (28 countries) I:*

- *implementation of the Declaration: minimum three-years of the first cycle is becoming the standard,*
- *two models:*
  - *BME is a component of a mixed degree*
  - *degrees are nominal in BME*
- *first cycle courses with BME degree*
  - *stand alone courses leading to technical/technician level qualification*
  - *first stage to a two-cycle degree*

## *Present situation and expectations for the future*

### *Survey specific to MBES (28 countries) II:*

#### *Second cycle,*

*the structure is particularly variable, 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 cycle.*

## *Present situation and expectations for the future*

### *Survey specific to MBES (28 countries) III:*

#### *Third cycle BME degrees (PhD)*

- *traditionally rather like a research apprenticeship, almost entirely research based*
- *growing tendency for the degree to contain instructional material*
- *minimum duration is three years.*

## *Present situation and expectations for the future*

*Survey specific to MBES (28 countries) IV:*

*Widespread recognition of the need for:*

*harmonized BME education, training and accreditation/certification throughout Europe*

## *Implementation*

*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 lead in developments related to their fields.*

***BME:** IFMBE, EAMBES, the national and trans-European BME societies.*

### *BIOMEDEA*

#### *Biomedical Engineering Preparing for the European Higher Education Area*

*a Europe-wide Participation Project contributing to the realisation of the European Higher Education Area (Bologna Process)*

*The objective of the project is to establish consensus on European guidelines for the harmonisation of MBES 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.*

*Targets for the dissemination of results will be the European universities, political decision makers, ENQA, accreditation agencies, health care providers and students.*

### *BIOMEDEA*

#### *Biomedical Engineering Preparing for the European Higher Education Area*

*A series of three symposia:*

- *Eindhoven, December 2004: Education, Training and Preparation for the Whitaker Summit 2005*
- *Warsaw, March 2005: Criteria for the accreditation of BME Programmes, and a European Protocol for the formation and training of clinical engineers*
- *Stuttgart, September 2005: + Certification and Registration of Individuals, Continuing Education*

### *BIOMEDEA*

#### *Biomedical Engineering Preparing for the European Higher Education Area*

##### *Results:*

- *Guidelines for:*
  - *harmonized higher MBES education and training*
  - *the accreditation of academic MBES programmes in Europe*
  - *the certification and registration of biomedical/clinical engineers in Europe, and*
  - *continuing education (life-long learning) in MBES*
- *Status report on MBES in Europe*
- *Student and teacher's guide for all local and international MBES programmes in Europe with special emphasis on mobility*



## The EUR-ACE Project Summary

The EUR-ACE project aims at setting up an European system for accreditation of Engineering education, with the following main aims: provide an appropriate “European label” to the graduates of the accredited educational programmes, improve the quality of educational programmes in engineering, facilitate trans-national recognition by the label marking, facilitate recognition by the competent authorities, in accord with the EU Directives and facilitate mutual recognition agreements. It will be a significant contribution to the harmonization of the European higher education.

Formal Partners:

FEANI, SEFI, CESAER, EUROCADRES, ENQHEEI, ASIIN, CTI, IEI, CoPI, UNIFI, OE, UAICR, RAEE, ECuk

## **EUR-ACE Partners:**

<b>FEANI</b>	(Fédération Européenne d'Associations Nationales d'Ingénieurs)
<b>SEFI</b>	(Société Européenne pour la Formation d'Ingénieurs)
<b>CESAER</b>	(Conference of European Schools for Advanced Engineering Education and Research)
<b>EUROCADRES</b>	(Conseil des Cadres Européens)
<b>ENQHEEI</b>	(European Network for Quality of Higher Engineering Education for Industry)
<b>ASIIN</b>	(Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics)
<b>CTI</b>	(Commission des Titres d'Ingénieurs)
<b>IEI</b>	(The Institutions of Engineers in Ireland)
<b>CoPI</b>	(Conference of Italian Engineering Deans)
<b>UNIFI</b>	(University of Florence)
<b>OE</b>	(Portuguese Institution of Engineers)
<b>UAICR</b>	(Union of Associations of Civil Engineers of Romania)
<b>RAEE</b>	(Russian Association for Engineering Education)
<b>ECuk</b>	(Engineering Council UK)

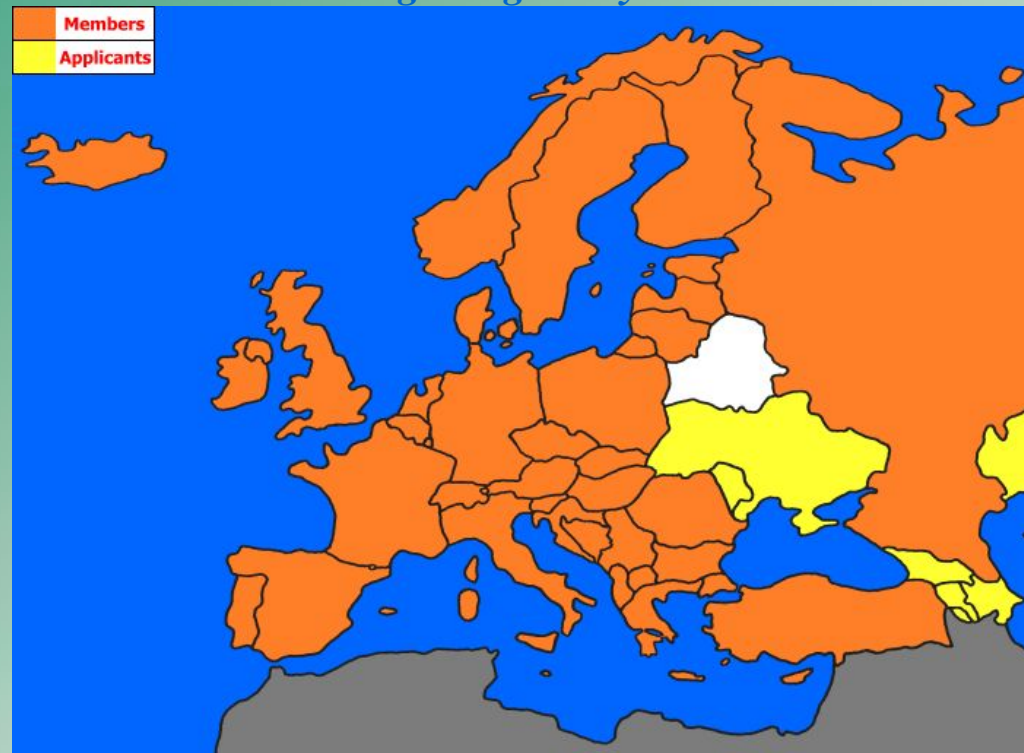


**The EUR-ACE project has accepted the BIOMEDEA consortium, and thus IFMBE and EAMBES, as the lead organization in specifying the specific requirements of European BME programmes with regard to quality assurance and accreditation. This corresponds to the role the Biomedical Engineering Society (BMES) is playing in the US with regard to ABET accreditation.**

**What does this mean for BME education in Europe?**



## *The Bologna signatory countries*



**Just in time for the 3rd follow-up conference of the Bologna Meeting, BME education in Europe has gained independence from its mother disciplines and the BME community has taken the responsibility to develop its own European Higher Education Area.**

## *BME Education – the European Approach*

*Keeping in mind that in addition to the Bologna process, innovative MBES teaching strategies and methods as well as new educational programmes, filling the gap between engineering and life sciences with a variety of new specialisations, are emerging throughout Europe, it does not surprise that NATURE stated in its September 2003 ‘careers and recruitment’ section that:*

*“Europe chips in for training. The United States may have more coordinated funding, but Europe is taking the lead in training biomedical engineers.”*