CURRICULA REFORMATION AND HARMONISATION IN THE FIELD OF BIOMEDICAL ENGINEERING:
THE TEMPUS IV CRH-BME PROJECT AT A GLANCE

Z. Bliznakov, R. Magjarevic, N. Pallikarakis
The BME field

Biomedical engineers must meet existing or forecasted needs by means of knowledge, skills and attitudes

- Need for a review of BME education European level
- Adoption to the new demands
- New challenges for advanced education in the BME field
The TEMPUS CRH-BME project

Aims and Objectives

Main objective is to update existing curricula in BME field in order to meet recent and future developments and address new emerging BME job market demands.
The TEMPUS CRH-BME project
Aims and Objectives

Specific objectives:

• Promotion of the development of new study programs
• Investigation of the possibilities for joint degrees
• Provision of a template guidance document for Quality Assurance (QA)
• BME laboratory modernisation
• Promotion of international teacher and student exchange mobility
• Dissemination of project results and Sustainability
The TEMPUS CRH-BME project

The consortium

Established according to the project objectives and real conditions - promote education in BME

• 23 Partners
  – 17 EU institutions
  – 6 Partner Countries’ institutions

• All partners have extensive experience with international projects
• Previous collaborations within ERASMUS, TEMPUS, TEMPERE, or other programs
The TEMPUS CRH-BME project

Implementation

Project implementation consists of:

• 9 Work Packages

• work carried out by Working Groups
The TEMPUS CRH-BME project

Expected Outcomes

- Report on the BME education status and future trends in Europe
- Generic Programs for graduate and postgraduate studies in BME
- Template guidance document for the implementation of a harmonised Quality Assurance System for BME education
- Development and implementation of new study programs and the restructuring of existing BME programs
- Establishment of Joint Degrees
- Dissemination of results
- Sustainability of results
The TEMPUS CRH-BME project

Review
on the BME education status
in Europe
Results

Review of the BME programs in Europe

- 46 Countries in Europe investigated
- 40 Countries have BME program
- ~ 160 Universities across Europe
- 327 BME programs
  - 95 Undergraduate - BSc
  - 232 Postgraduate - 167 MSc, 65 PhD

~ 30 % BSc, ~ 50 % MSc, ~ 20% PhD
Conclusions from the Review

The results of this study reveal that Biomedical Engineering programs are experiencing rapid growth after the year 2000 and especially during the last five years.

This leads to an increased number of Biomedical Engineers available on the market today.
The TEMPUS CRH-BME project

Generic Programs
for
graduate and postgraduate studies
in Biomedical Engineering
BME programs

Five generic types of BME programs are envisioned based on previous experience and gathered information about specific needs in different environments:

- 1\textsuperscript{st} cycle BME program for employment.
- Integrated 1\textsuperscript{st} and 2\textsuperscript{nd} cycle BME program.
- Stand-alone 2\textsuperscript{nd} cycle BME program with entry from 1\textsuperscript{st} cycle BME program.
- Stand-alone 2\textsuperscript{nd} cycle BME program with entry from 1\textsuperscript{st} cycle engineering or physical sciences program.
- Stand-alone 2\textsuperscript{nd} cycle BME program with entry from 1\textsuperscript{st} cycle medical or biological program.
<table>
<thead>
<tr>
<th>Degree / Programme</th>
<th>Type 1 1st cycle BME for employment</th>
<th>Type 2 Integrated 1st &amp; 2nd cycle BME</th>
<th>Type 3 Stand alone 2nd cycle BME (entry from 1st cycle BME)</th>
<th>Type 4 Stand alone 2nd cycle BME (entry from 1st cycle Engineering or Physics)</th>
<th>Type 5 Stand alone 2nd cycle BME (entry from 1st cycle Medical or Biological)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topic category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Engineering and Physical Sciences</td>
<td>70</td>
<td>100</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Engineering and Physical Sciences focused on BME applications</td>
<td>20</td>
<td>40</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Basic Biological and Biomedical Sciences</td>
<td>15</td>
<td>25</td>
<td>5</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Biological and Biomedical Sciences focused on BME applications</td>
<td>20</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>General introduction to BME and BME specialisation</td>
<td>30</td>
<td>60</td>
<td>20</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Generic skills (verbal and written communications,…)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethics (general, medical, research)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>10</td>
<td>15</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Visits to / from companies or lectures / seminars from staff of relevant institutions (clinical, industry, BME departments, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BME Research project for thesis</td>
<td>15</td>
<td>30</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td><strong>Minimum total ECTS</strong></td>
<td><strong>180</strong></td>
<td><strong>300</strong></td>
<td><strong>90</strong></td>
<td><strong>90</strong></td>
<td><strong>90</strong></td>
</tr>
</tbody>
</table>
Generic BME curriculum

- BME Core topics
- BME Elective topics
BME Core topics

- Biomaterials
- Biomechanics
- Biomedical data and signal processing
- Biomedical instrumentation and sensors
- Health technology design, assessment and management
- Information and communication technologies in medicine and healthcare
- Medical imaging and image processing
BME Elective topics

- Huge variety of titles
- Satisfy specific need of the BME program

Examples:
- Anatomy & Physiology
- Biology & Biochemistry
- Control theory, Modelling and Simulation
- Research Methodology
- Cell & Tissue Engineering
- Gene & Molecular Engineering
- Telemedicine
- Artificial Intelligence
- Diagnostic & Therapeutical Methods
- Ultrasound
- Nanotechnology
- Clinical Engineering
- Rehabilitation Engineering
- Patient Safety
- ...
BME programs Harmonization Recommendations

- The table should be taken as a guideline.
- Deviations (up to 10 ECTS) are expected for the different topic categories.

- The BME programs (1\textsuperscript{st} or 2\textsuperscript{nd} cycle) should cover at least 4 out of the 7 Core topics in sufficient breadth and details.

- Elective topics are introduced according to the specific needs of the BME program.
The TEMPUS CRH-BME project

Achieved Results

Summary
CRH-BME Results

- Review of the BME educational programs in Europe - 327 programs in 40 countries across Europe.
- Five types of Generic Programs for BME graduate and postgraduate studies were proposed as a guideline for the harmonisation of studies in the field.
- Review of the current Quality Assurance and Accreditation systems in BME Education in Europe and a Template Guidance Document for the implementation of harmonised Quality Assurance Systems.
CRH-BME Results

- Development and implementation of 8 new study programs and restructuring of 12 existing ones according to the CRH-BME proposed guidelines.
- Equipment acquisition and BME laboratory modernization in 4 Partner Countries’ Universities.
- Training of 9 students from Partner Countries’ Universities at EU Countries’ Universities of their own preference for a period of up to 3 months.
CRH-BME Results

- Investigation of the possibilities for implementation of a joint degree in BME programs at partners’ Universities.
- Signature of more than 10 Bilateral agreements between the participating Universities from the project consortium or between the participating Universities and other Universities outside the consortium, initiated through the project actions.
- Numerous presentations in 13 International Conferences and 6 specialized Workshops in BME, which were organized for project results dissemination. Publication of more than 20 papers in scientific National and International Journals.
Biomedical Engineering Education

CRH-BME TEMPUS IV Project

Curricula Reformation and Harmonisation in the Field of Biomedical Engineering

The CRH-BME project - Curriculæ Reformation and Harmonisation in the Field of Biomedical Engineering is a Joint Project within the TEMPUS IV program, involving 17 Institutions from EU and 6 Institutions from Partner Countries. The main objective is to update existing curricula in the field of Biomedical Engineering in order to meet recent and future developments in the area, address new emerging inter-disciplinary domains that appear as a result of the R&D progress and respond to the Biomedical Engineering job market demands. The generic Biomedical Engineering programs will assist participating institutions to restructure their existing programs in full compliance with the Bologna Declaration and the ECTS and especially those that are in their initial stage of their educational system reform.

University of Patras

News

11 - 13 November 2010
4th General Assembly Meeting, Ljubljana, Slovenia

20 - 22 October 2010

Latest Announcements

5th General Assembly Meeting
19 - 21 May 2011, Oulu, Finland
Host Institution: University of Oulu
The TEMPUS CRH-BME project

Conclusions

The CRH-BME project under the TEMPUS IV Program has played an important role in the updating and harmonisation of the BME studies across Europe, according to the existing and forecasted needs.
Acknowledgements

CRH-BME
Curricula Reformation and Harmonisation in the field of Biomedical Engineering
Project Number: 144537-TEMPUS-2008-GR-JPCR (2008-4527)
is a Joint Project within the TEMPUS IV program and is 95% financed by the Commission of the European Communities.