The tuning methodology Scheme

The TUNING project is a project by and for universities.

It is the Universities' response to the challenge of the Bologna Declaration

Tuning of educational structures and programmes on the basis of diversity and autonomy

BOLOGNA KEY POINTS

Adoption of a system of easily readable and comparable degrees

Adoption of a system essentially based on two cycles

Establishment of a system of credits

Promotion of mobility

Promotion of European co-operation in quality assurance

Promotion of the European dimension in higher education

Lifelong learning

Higher education institutions and students

Promoting the attractiveness of the European Higher Education Area

Doctoral level introduced Berlin 2003 (third cycle).

THE «TUNING METHODOLOGY»

«Tuning educational structures in Europe»

http://europa.eu.int/comm/education/policies/educ/tuning/tuning_en/html

A PILOT EUROPEAN PROJECT (SOCRATES)

University of DEUSTO (BILBAO – SPAIN)

University of GRONINGEN (The NETHERLANDS)

contribution to the elaboration of compatible qualifications in the European countries, described in terms of

- *workload*
- *level*
- *profile*
- *learning outcomes*
- *common language overarching European famework of qualifications*.

NOT FOR HARMONISATION OF THE PROGRAMMES BUT FOR POINTS OF REFERENCE, CONVERGENCE, COMMON UNDERSTANDING.

For the whole of higher education in Europe

10 disciplines have produced statements of competences/learning outcomes

5 LINES OF APPROACH IN THE TUNING METHODOLOGY

Generic competences

Subject specific competences

the role of ECTS as an accumulation system

The role of learning, teaching, assessment and performance in relation to quality assurance and evaluation.

What should a student know, understand and be able to do to be employable? moving from a staff oriented approach to a student centred approach

DEFINITIONS

What «competences» a graduate student should have (1rst step) term which represents a dynamic combination of attributes, abilities and attitudes

Competences

- belong to students or graduates
- are the mirror image of the learning outcomes

«Learning outcomes» (knowledge, skills and understanding)

- set by the teaching staff
- refer to the whole programme
- relate to the point of graduation

«learning objectives»

- set and described by the teaching staff
- related to a particular component of a degree programme

QUESTIONNAIRE TUNING EDUCATIONAL STRUCTURES IN EUROPE

Not a survey BUT an attempt to reach agreement about which competences/learning outcomes are sufficiently important to merit inclusion in each degree progammes in Europe

to establish opinion accross Europe about the competences that should be demonstrated by

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students at the end of their training to become a professional to rate a series of competences/learning outcomes for a specific profession in terms of their importance.: not important, quite important, important, very important

4 SECTIONS

To rate a series of competences/learning outcomes in terms of their Importance: not important, Quite important, Very important, essential

Section A - Generic – (general academic competences)

* instrumental competences
* interpersonal competences
* systemic competences

Section B - Subject-specific competences

* B1 broad areas of competency
* B2 Detailed subject-specific competences

Section C - Knowledge and experiential learning for a specific graduation in support of the competences/oucomes above

SECTION A: TUNING PROJECT GENERIC COMPETENCES (PERSONAL AND PROFESSIONAL)

research skills
basic general knowledge
creativity
ethical commitment
ability to design and manage projects
appreciation of diversity and multiculturality
capacity to adapt to new situations
critical and self-critical abilities
ability to make decisions
interpersonal skills
ability to communicate with experts in other fields
capacity for analysis and synthesis
ability to work in an international context
capacity for organisation and planning (including time management)
understanding of cultures and customs of other countries
ability to teach others
ability to recognise limits and ask for help
probity (honesty, maintaining good practice)
ability to communicate with experts in other fields
capacity for analysis and synthesis
ability to work in an international context
capacity for organisation and planning (including time management)
understanding of cultures and customs of other countries
ability to teach others
ability to recognise limits and ask for help
probity (honesty, maintaining good practice)
Ability to solve problems
Capacity to learn (including lifelong self-directed learning)
empathy
ability to lead others
knowledge of a second language
ability to work autonomously
will to succeed
capacity for applying knowledge in practice
concern for quality
initiative and entrepreneurial spirit
ability to work in a multidisciplinary team
research skills
basic general knowledge
creativity
ethical commitment

ARE THERE ANY OTHER GENERIC COMPETENCES/OUTCOMES WHICH YOU THINK MIGHT BE RELEVANT FOR THIS KIND OF TRAINING?

SECTION B1: TUNING SUBJECT-SPECIFIC COMPETENCES for this kind of training

This section asks about competences/learning outcomes which are specific to the specific kind of training programme

SECTION B2: Detailed tuning subject specific competences for this training programme

ARE THERE ANY OTHER AREAS OF SUBJECT-SPECIFIC COMPETENCES/OUTCOMES FOR PAEDIATRIC TRAINING

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WHICH YOU THINK ARE IMPORTANT? (you may wish to return to this question after completing the other sections)

ISSUES FOR DEBATE AND DISCUSSION

1) Which workpackage is concerned by EDUCATION «to develop new curricula at international level»

2) As to define competences in the programme specify to which kind of qualification for which profession this programme leads

3) Biotechnology leading to a profession? a qualification? Which level? bachelor? Master?

FOR EACH COURSE IMPLEMENTED

But this is not really tuning methodology

Just a part of it, a method

Course title

Content

Prerequisite

competences

Learning objectives

ECTS credits based on student workload

Identify Type of qualification obtained for which profession

THEN

we may be able to prepare a specific questionnaire (tuning methodology) as to define the generic and the specific competences related to this profession.

Validation by the «tuning group» and proposed to the EU

1) workpackage - Genomics participation to international course

2) Workpackage - to promote the field of polymers Course of biomaterial in medicine

3) Workpackage - Biosensor application in medicine food and environment ODL module

4) Workpackage - Application of immunology in Bioitechnology Course for Bachelor of biotechnology degree

5) Workpackage - Microbial adaptation to environmental changes: innovative educational and technological aspects

6) Workpackage - Molecular diagnostics of microorganisms Higher education training course and manuals

7) Workshop - creation of a learning platform for Biotechnology disciplines

8) Workshop - international veterinary course

9) Workshop – Diet and dietary patterns in gastrointestinal

10) Workshop - Identification of vegetal product authenticity

11) Collaboration with enterprises in the formation enterprises have to give their advice, in the tuning methodology, on competences

« Tuning educational structures in Europe »

http://europa.eu.int/comm/education/policies/educ/tuning/tuning_en/html is a pilot European project (Socrates), coordinated by the University of DEUSTO (BILBAO – SPAIN) and the University of GRONINGEN (The NETHERLANDS)

Its main objective is to contribute to the elaboration of compatible qualifications in the European countries, described in terms of :

- ✓ workload
- ✓ level
- ✓ profile
- ✓ learning outcomes
- ✓ with a common language overarching European framework of qualifications.

It is the Universities' response to the challenge of the Bologna Declaration on the basis of diversity and autonomy.

It is not for harmonization of the programmes BUT for points of reference, convergence, common understanding, for the whole of higher education in Europe.

9 disciplines have produced statements of competences/learning outcomes.

There are 5 lines of approach in the tuning methodology. There are :

- ✓ generic competences

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- ✓ subject specific competences (knowledge, understanding and skills)
- ✓ ECTS as a European credit accumulation system: new perspectives
- ✓ mapping of approaches to teaching / learning and assessment in different countries
- ✓ quality enhancement

Some définitions :

- « competences » :
  This term represents a dynamic combination of attributes, abilities and attitudes :
  - belong to students or graduates
  - are the mirror image of the learning outcomes
- « learning outcomes » (knowledge, skills and understanding) :
  - are set by the teaching staff
  - refer to the whole programme
  - relate to the point of graduation
- « learning objectives » :
  - are set and described by the teaching staff
  - are related to a particular component of a degree programme

A questionnaire has been launched by the Tuning group.

➢ It is not a survey

➢ BUT an attempt to reach agreement about which competences/learning outcomes are sufficiently important to merit inclusion in each degree programmes in Europe.

➢ Its aim is to establish opinion across Europe about the competences that should be demonstrated by students at the end of their training to become a professional.

INTRODUCTION

OBJECTIVES:

As "tuning" methodology has not yet been applied to biotechnology, one of the objective of the work package is to do it.

Also to apply tuning methodology to the international course in biotechnology developed by Perugia University

Also to extend this analysis to other existing national curricula

PARTNERS INVOLVED IN THE WORKPACKAGE

- Pr. M. P. Viola-Magni
- Pr. MAFFIA
- Pr.Rocha
- Pr. Yotova
- Pr. Rode
- Pr. Viesturs
- Pr. Krajcovic
- Pr. Bruschi

WHAT IS "TUNING"?

«Tuning educational structures in Europe» http://europa.eu.int/comm/education/policies/educ/tuning/tuning_en/html is a pilot European project (Socrates) Coordinated by the University of DEUSTO (BILBAO – SPAIN) and the University of GRONINGEN (The NETHERLANDS)

Its main objective is to contribute to the elaboration of compatible qualifications in the European countries, described in terms of

- workload
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- learning outcomes

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There are 5 lines of approach in the tuning methodology:

- Generic competences
- Subject specific competences (knowledge, understanding and skills)
- ECTS as a European credits accumulation system
- Mapping of approaches to teaching / learning and assessment in different countries
- Quality enhancement

In the "tuning" methodology, some terms have to be defined:

- «competences»

This term represents a dynamic combination of attributes, abilities and attitudes

Competences - belong to students or graduates

- They are the mirror image of the learning outcomes

- «Learning outcomes» (knowledge, skills and understanding)

- are set by the teaching staff
- refer to the whole programme
- relate to the point of graduation

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THE TUNING METHODOLOGY APPLIED TO BIOTECHNOLOGY

One of the objectives of the work package "tuning" was to identify the generic and the subject specific competences which should be obtained in a biotechnology programme.

Biotechnology aims to prepare graduates to be employed in different areas of industry such as biopharmaceuticals, food, and environment. Also they can find many kinds of employment in health care area.

A questionnaire has been developed in English language with the collaboration of experts in biotechnology, participating to the work of the workpackage "collaboration with enterprises" in the formation, led by Prof. Eichinger

Competences have been revisited at various points as to adapt the questionnaire proposed by the tuning group more specifically to biotechnology.

The questionnaire was disseminated using the on line system be disseminated to teachers, students and enterprises.

It is not a survey but an attempt to reach agreement about which competences/learning outcomes are sufficiently important to merit inclusion in each degree programmes in Europe and to establish opinion across Europe about the competences that should be demonstrated by students at the end of their training to become a professional

Participants were asked to a series of competences/learning outcomes for a specific profession in terms of their importance:.

not important, quite important, important, very important

They were also given the opportunity to write a free text response on whether they felt there were other competences which graduate should have and which were not included into the questionnaire.

http://www.ebtna.net/biotechnology_step1.php

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SURVEY OF DEGREE QUALIFICATION AND PROGRAMMES IN BIOTECHNOLOGY IN EUROPE

This survey was conducted in 31 European countries, as to compare in the different European countries the typical degrees offered in biotechnology with their programme content and competences related to kinds of employments offered to biotechnologists

QUESTIONNAIRE PROCEDURE & METHODOLOGY

A questionnaire was developed in English language using the "online" system. An informative e-mail was composed containing a hyperlink to the questionnaire and requesting subjects to participate. One or more academics in almost all participant countries was nominated
responsible for identifying appropriate academics, graduates (who had gained a biotechnology degree in the previous 5 years), employers (generally biotechnology companies managers), students and professional bodies within their own countries to whom they would send the e-mail request to participate containing the hyperlink to the online questionnaire. Several international networks and members of the survey team also distributed the participation request to appropriate respondents. All respondents saw the same e-mail, participant instructions and questionnaire.

Participants were asked to rate each of the generic Tuning competences using a Likert scale of 1 ('not important'), 2 ('quite important'), 3 ('very important') or 4 ('essential').

They were also given an opportunity to write a free-text response on whether they felt there were other generic (non subject-specific) competences which graduates should have which had not been included in the questionnaire.

Because the questionnaire was accessed online by participants, and considered to be potentially sensitive (as reinforced by a number of free-text responses stressing the importance of anonymity), respondents were not absolutely required to submit personal information such as contact details, their academic role or affiliated institution, although most chose to do so when asked. Whilst the absence of this information in some ways makes analysis and quality assurance more difficult, it was felt necessary in order to respect the privacy and explicit wishes of some participants. IP addresses were automatically recorded in the system, providing a safeguard against submission of
multiple responses. In keeping with previous Tuning questionnaires, participants were grouped according to category of respondent, namely Student, Employer and Academic. Average ratings and rankings of the generic competences were created and compared for each of the principal groups
individually and collectively.

For each learning outcome the average importance rating for different groups of participants and for all respondents together were calculated. Average importance ratings were ranked in-order of importance and then rankings were compared between groups.

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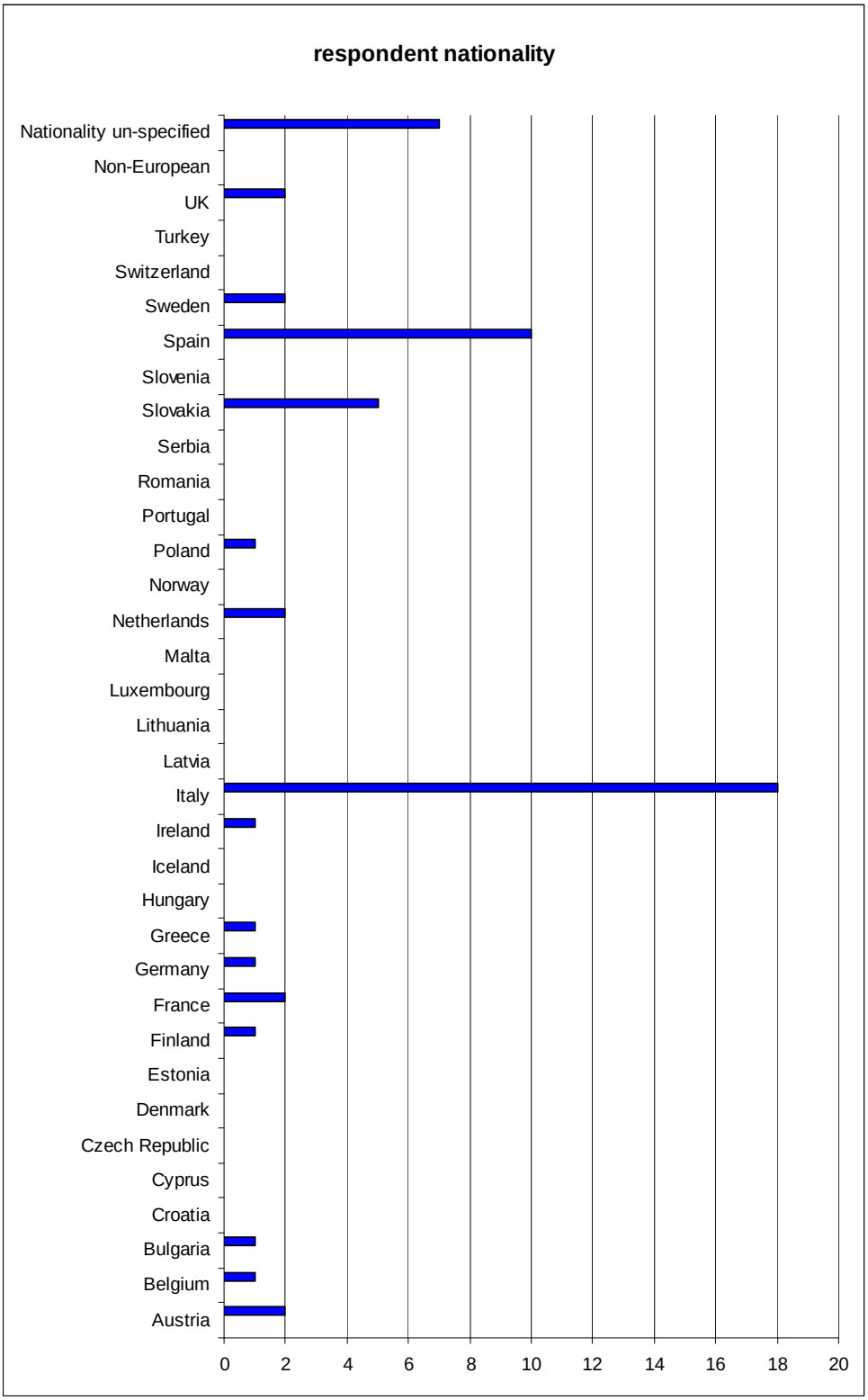
QUESTIONNAIRE RESULTS

Demographic results - Respondent nationality



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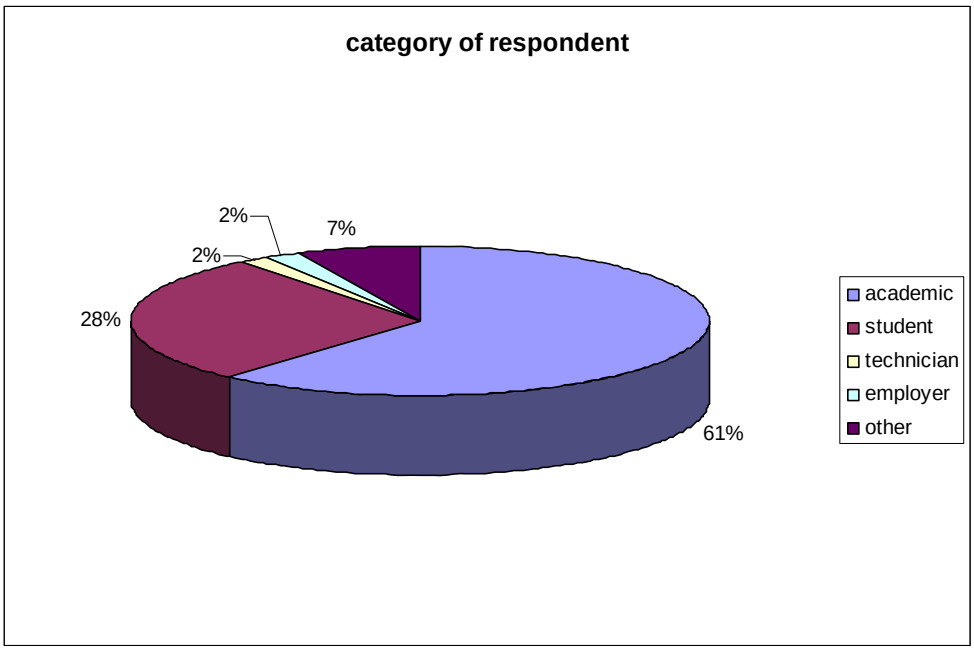
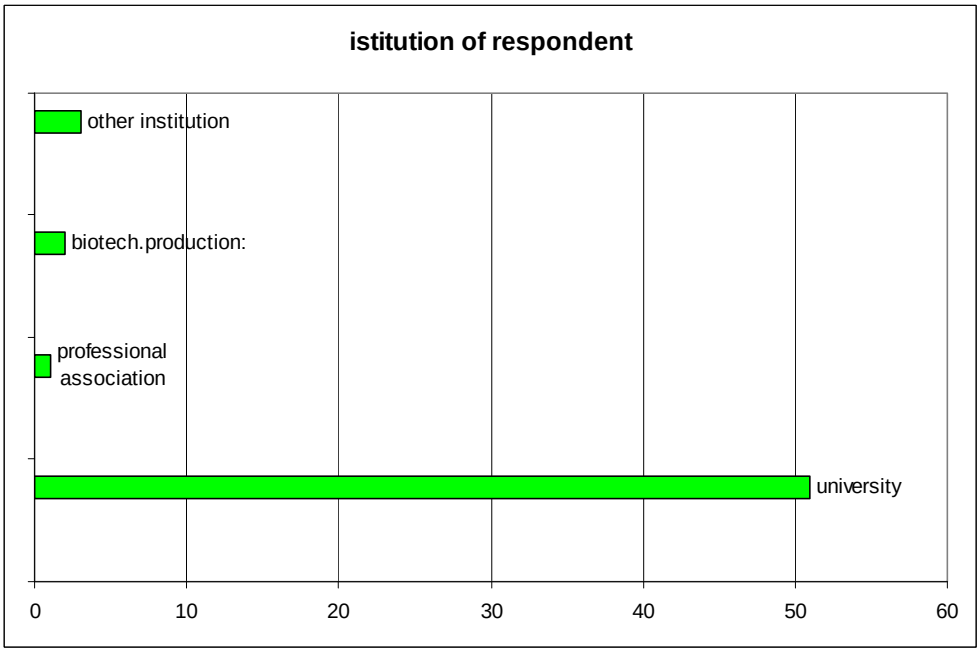
Category of respondent



Employing or affiliated institution of respondent



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CONTENT OF THE GENERIC QUESTIONNAIRE

Tuning aims to identify shared attributes which could be general to any degree, and which are considered important by different social groups (particularly former graduates and employers). Certain competences such as 'capacity to learn', 'capacity for analysis and synthesis' are considered common to all degrees. Our survey carefully considered the 30 Tuning generic competences in relation to the field of biotechnology education and chose to use 16 of the Tuning generic competences without modification (labelled 'imp_' below with the 'importance item' unique identifier from previous Tuning literature); 8 Tuning generic competences with slight modification (labelled 'imp_b' to denote the source competence with modification); and developed 4 new 'generic' competences (labeled 'biot_') which were particularly important in biotechnology but would also be common to almost all other disciplines, unlike the biotechnology subject-specific competences. The first section of the final questionnaire comprised ratings of the following 28 generic competences:

imp1 capacity for analysis and synthesis

imp2 capacity for applying knowledge in practice

imp3 capacity for organisation and planning

imp4b basic general knowledge outside biotechnology

imp7 knowledge of a second language

imp9 research skills

imp10b capacity to learn (including lifelong self-directed learning)

imp12 critical and self-critical abilities

imp13 capacity to adapt to new situations

imp14b creativity

imp15b ability to solve problems

imp16b ability to make decisions

imp18 interpersonal skills

imp19b ability to lead others

imp20b ability to work in a multidisciplinary team

imp21 ability to communicate with experts in other fields

imp23 ability to work in an international context

imp24 understanding of cultures and customs of other countries

imp25 ability to work autonomously

imp26b ability to design and manage projects

imp27 initiative and entrepreneurial spirit

imp28 ethical commitment

imp29 concern for quality

imp30 will to succeed

biot1 empathy

biot2 ability to teach others

biot3 ability to recognise limits and ask for help

biot4 probity (honesty, maintaining good practice)

Generic competences in rank order of importance with average ratings of all survey respondents

(1=not important; 2=quite important; 3=very important; 4=essential)

Generic Competency	Rating
ability to solve problems	3,47
probity (honesty, maintaining good practice)	3,45
capacity to learn	3,39
capacity for applying knowledge in practices	3,38
research skills	3,35
capacity for analysis and synthesis	3,30
ability to work in a multidisciplinary team	3,27
capacity to adapt to new situations	3,25
ability to make decisions	3,18
capacity for organisation and planning (including time management)	3,18
ability to design and manage projects	3,16
critical and self-critical abilities	3,16
knowledge of a second language	3,15
concern for quality	3,10
ability to communicate with experts in other fields	3,07
ability to work in an international context	3,07
ability to recognise limits and ask for help	3,07
creativity	3,06
ethical commitment	3,04
ability to work autonomously	3,02
will to succeed	3,01
basic general knowledge	2,73
initiative and entrepreneurial spirit	2,72
interpersonal skills	2,61
ability to teach others	2,61
ability to lead others	2,53
understanding of cultures and customs of other countries	2,46
empathy	2,38

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Participants were also asked “Are there any other generic competences / outcomes which you think might be relevant for biotechnology graduates?”.

The majority of these could be categorised under the existing generic competences, for example, “Open minded” can be included in the categories imp14b, imp24 and imp27.

A number of apparently new generic themes emerged however, and these are listed below:

- Ability to familiarize
- Motivation
- Selection of the shorter way to accomplish the target

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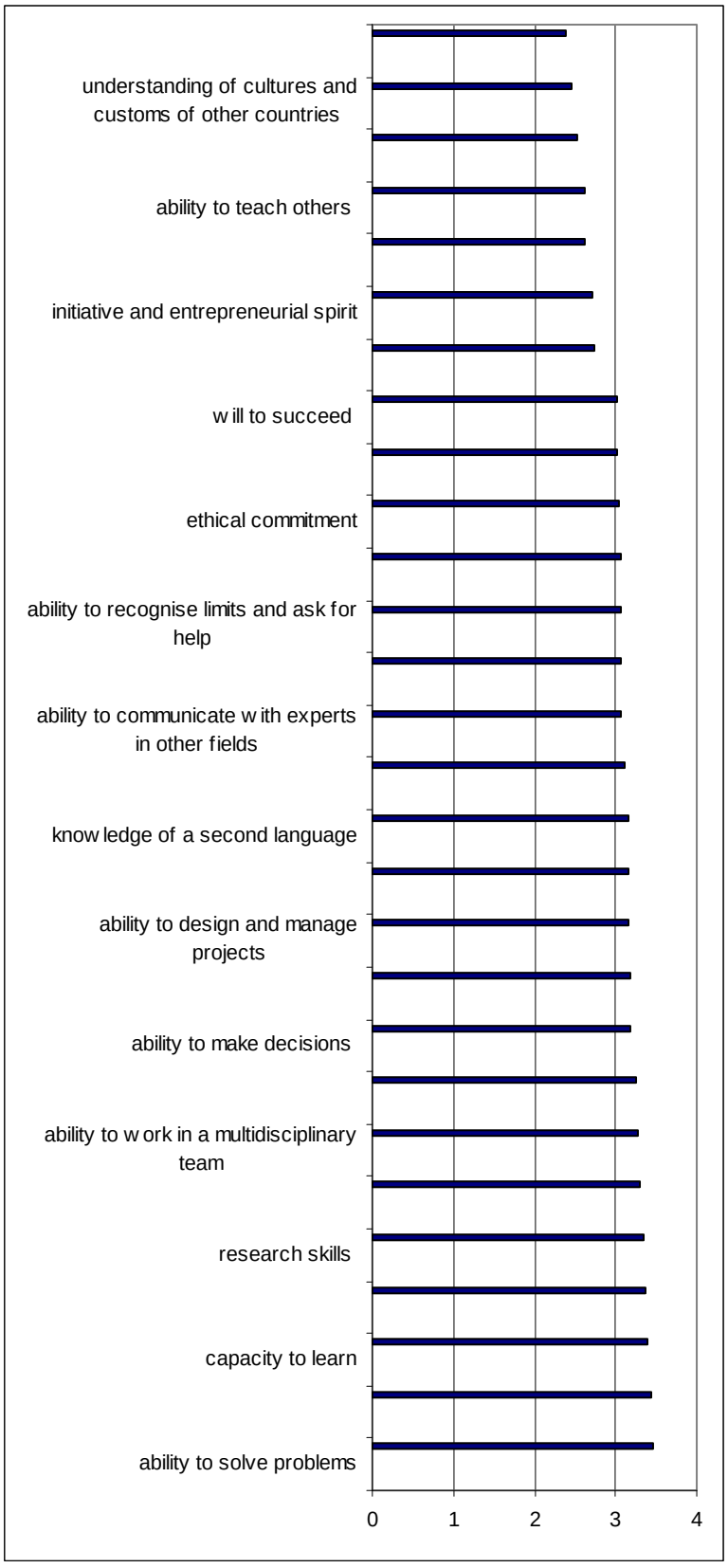

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SUBJECT SPECIFIC COMPETENCES FOR BIOTECHNOLOGY

Thirty subject-specific competences were agreed. These constituted large, important areas of teaching, learning and assessment. Along with the generic Tuning competences they were felt to encompass all of the competences required by new biotechnology graduates.

They formed the second section of the Tuning questionnaire, as follows:

- ability to negotiate a management plan
- ability to communicate effectively
- ability to carry out practical procedures
- ability to apply scientific principles
- ability to carry out evidence-based research
- ability to use information
- ability to apply ethical and legal principles
- ability to communicate with partners
- ability to communicate with colleagues
- ability to communicate with interpreter
- ability to communicate in writing
- ability to communicate by telephone
- ability to apply scientific principles to the practice
- ability to design research experiments
- ability to carry out practical laboratory
- ability to carry out an appropriate literature search
- ability to use information from published biotechnological literature
- ability to apply statistical analysis
- ability to use computers
- ability to access information sources
- ability to store and retrieve information
- ability to obtain informed consent
- ability to maintain confidentiality
- ability to apply ethical principles
- ability to apply national and European law
- ability to provide evidence to a court of law
- ability to conform with professionals
- ability to receive and provide professional appraisal
- ability to make career choices

The same procedure was employed for the subject-specific competences as for the generic Tuning competences in biotechnology.

Free text responses to the question “Are there any other areas of subject-specific competences / outcomes for medicine which you think are important?” were analysed. One new outcome was identified by this process.

- Do not forget reality

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Subject Specific competences in rank order of importance with average ratings of all survey respondents

Likert scale 1 (not important) to 4 (essential).

Subject Specific Competency	Rating
ability to design research experiments	3,35
ability to apply scientific principles to the practice	3,28
ability to apply scientific principles	3,24
ability to carry out evidence-based research	3,19
ability to carry out practical laboratory	3,17
ability to complete records	3,17
ability to access information sources	3,15
ability to use computers	3,14
ability to use information	3,10
ability to carry out an appropriate literature search	3,10
ability to store and retrieve information	3,08
ability to communicate in writing	3,07
ability to carry out practical procedures	3,06
ability to apply statistical analysis	3,01
ability to use information from published biotechnological literature	3,00
ability to communicate effectively	2,98
ability to communicate with colleagues	2,94
ability to apply national and European law	2,94
ability to apply ethical principles	2,90
ability to maintain confidentiality	2,89
ability to apply ethical and legal principles	2,83
ability to communicate with partners	2,83
ability to obtain informed consent	2,83
ability to negotiate a management plan	2,73
ability to conform with professionals	2,65
ability to receive and provide professional appraisal	2,58
ability to communicate by telephone	2,57
ability to make career choices	2,55
ability to provide evidence to a court of law	2,35
ability to communicate with interpreter	2,32

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KNOWLEDGE OUTCOMES

A part of the web-base questionnaire survey was to gather opinion about important areas of knowledge for biotechnology graduates. They formed the second section of the Tuning questionnaire, as follows:

The ranked results are shown below. In general, the highest scores and rankings related to knowledge of traditional scientific disciplines, such as molecular and cell biology, biochemistry, immunology and general physiology, together with clinical sciences such as pathology, clinical pharmacology, immunological and inherited diseases and technological knowledge such us general technology, bio processing and material sciences. The lowest scores related to knowledge of "behavioural and social sciences/politics and economics".

Ranked knowledge outcomes

Likert scale 1 (not important) to 4 (essential)

knowledge outcomes	Rating
molecular and cell biology	3,44
appropriate literature search	3,16
biochemistry	2,98
pathology	2,97
immunology	2,96
general technology	2,95
immunological disease	2,94
antibiotic resistance	2,94
inherited disease	2,90
general physiology	2,85
drug action and pharmacokinetics	2,82
bio processing	2,78
drug side effects	2,72
drug interactions	2,68
Disease prevention	2,66
disease surveillance	2,61
material sciences	2,48
epidemiology	2,45
lifestyle, diet and nutrition	2,39
basics in anatomy	2,34
global health and inequality	2,27
health promotion	2,23
complementary medicine	2,20
ethnic influences	2,19
resource allocation	2,19
gender issues	2,14
disability	2,10
national economic	1,90
politics	1,73
psychology	1,72
sociology	1,61

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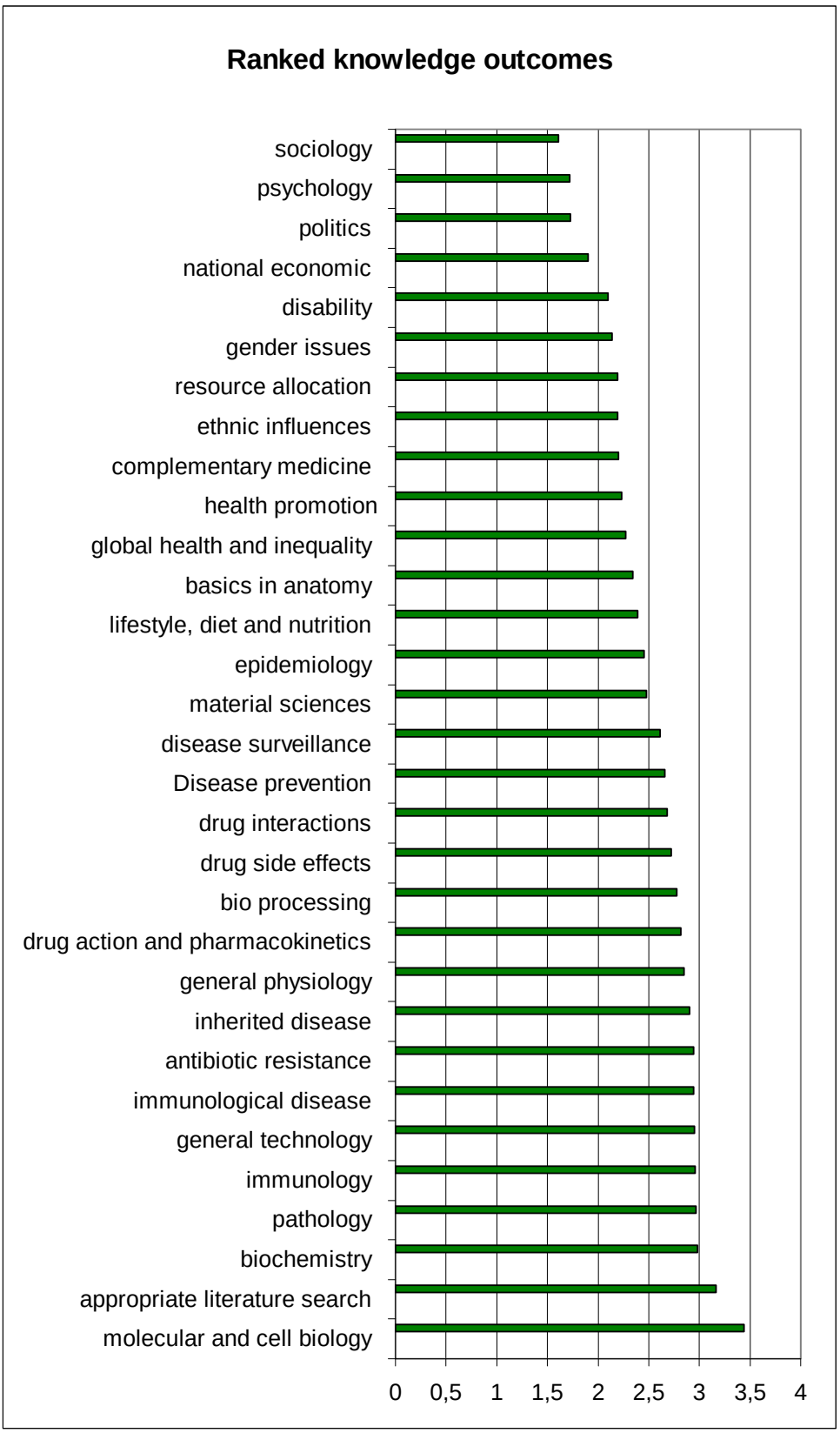

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BIOTECHNOLOGY

PROGRAMMES IN EUROPE

DEGREE PROFILE(S)

Typical degrees offered in Biotechnology

Cycles	Examples of Typical Degrees Offered
First	BSc in (name subject area/specific parts) Biotechnology Biochemistry and Biotechnology Biomedicine & Biotechnology Genetics and Biotechnology Gene Technology Agricultural Biotechnology Biological Applications and Technologies Food Biotechnology Environmental Plant Biotechnology Bioengineering Job Creation Oriented Biotechnology
Second	MSc in (name subject area/specific parts) Master degrees may be purely by research or, more typically, by a mixture of course work and a substantial thesis component, usually involving one of the sub-disciplines. A significant number of such courses have a strong vocational component. Biotechnology Biochemistry and Biotechnology Biomedicine & Biotechnology Biotechnology Medical Application Biotechnology and Bioanalysis Cell Biology and Biotechnology Bioactive Products and Protein Technology Protein Biotechnology Microbial Biotechnology Applied Genetics and Biotechnology Pharmaceutical Biotechnology Biopharmaceutical Engineering Food Biotechnology Biotechnology - Quality Assessment in Nutrition and the Environment Biotechnology and Food Quality Plant Molecular Biology and Biotechnology Biodiversity and Plant Biotechnology Aromatic and Medicinal Plant Biotechnology and Bioentrepreneurship Marine Biology and Biotechnology Ecological Biotechnology Molecular and Cellular Gene Technology Biological Engineering Industrial Biotechnologies Biotechnology and Business
Third	PhD in (name subject area/specific parts) Doctorate by research, usually requiring examination and defense of a substantial and original piece of research described in a comprehensive thesis

Typical occupations of the graduates of biotechnology

Biotechnologists find ready employment in rewarding jobs across the growing 'smart economy', including industries such as biopharmaceuticals, diagnostics, health care, food and the environment. Biotechnology graduates are equipped with a strong range of capabilities, including business and language skills, which complement their knowledge of biology. This also allows them to move into areas such as management and marketing where the biotech revolution continues to open doors.

Biotechnology graduates frequently pursue advanced training and research in PhD, Masters and graduate diploma programmes, spanning areas as diverse as biochemistry, pharmacology, environmental science and immunology.

Cycles	List of professions related to Biotechnology
First	Technical jobs in governmental organizations or private sector at intermediate decision levels Biotechnology industries Secondary school teacher (initial years)*
Second	Biotechnologists in universities and research institutes Research assistants in universities, institutes and industries Industrial biotechnologists in companies (pharmaceutical, chemical, agriculture and food industries, water companies and waste management sectors, production of diagnostic tools for the detection, monitoring and removal of environmental pollutants, biomedical diagnostic and research services, sales, marketing and regulatory affairs, bioinformatics etc.) Health care institutions public and private Environmental specialists and consultants in government agencies and private institutions. Teachers at secondary and high schools* Teachers in private organizations Science journalists in media houses Proceed into the third educational qualification PhD degree in the same professional field.
Third	University research University teaching Industrial research Secondary school teaching* Biotechnology business

*The route to qualifications, which enables to teach, varies substantially across Europe. In some countries teaching qualifications are obtained independently of the university degree. In some others teaching is a specialization of a biotechnology degree or even a completely independent degree. So the situation described in the table is not universal.

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WORKLOAD AND ECTS

Cycle	ECTS Credits	Duration
First	180-240	3-4 years
Second	60-120	1-2 years
Third	*not* expressed in ECTS	3-4 years

Most European countries typically award a First Cycle Bachelors Degree after 3 years and 180 ECTS or 4 years and 240 ECTS. The first model is currently the most common. A variety of models exists for Second Cycle Masters Degree which are awarded after 1 or 2 years and 60, 90 or 120 ECTS.

Trends and differences within the higher education European area in this subject

United Kingdom and Ireland have a 4 years First Cycle Bachelors Degree with 240 ECTS and an 1 year Second Cycle Masters Degree with 60 ECTS, but all the universities are not conformed with the ECTS system.

Bulgaria has a 4 years First Cycle Bachelors Degree and an 1 year Second Cycle Masters Degree with 240 and 60 ECTS respectively.

Greece has a 4 or 5 years First Cycle Bachelors Degree with 240-300 ECTS and a 1 or 2 years Second Cycle Masters Degree with 60-120 ECTS.

Cyprus has only a First Cycle Bachelors Degree of 4 years and 240 ECTS.

Luxemburg has only a Second Cycle Masters Degree of 2 years and 120 ECTS.

Biotechnology curricula

First cycle:

They have a "core" of at least 90 ECTS of compulsory modules, from the following areas:

- chemistry
- physics
- cell and molecular biology
- genetics
- biochemistry
- physiology
- microbiology
- immunology
- pharmacology

semi-optional courses covering further sub-disciplines of at least 15 ECTS

optional courses

a Bachelor thesis of 15-30 ECTS.

Second cycle:

The major element of the Master programmes is the research component which covers between 30 and 60 ECTS.

The compulsory element is usually small and very flexible as there is a connection between the coursework and the direction of the chosen research area.

Third cycle:

There are not defined curricula

COMPETENCES

A research of the biotechnology under and postgraduate courses curricula offered by the European universities, showed that the Generic Competences and the Subject Specific Competences are shared by all of them.

Taking in consideration that the biotechnology courses are organized by a multitude of Faculties, Schools and Departments, such as, Medicine, Agriculture, Biology, Chemistry, Pharmacy, Polytechnic schools etc., the Knowledge Outcomes ranking, differs according to the scientific direction that each degree is taking especially during the second cycle of the studies. But all the important areas of knowledge for biotechnology graduates mentioned in the survey, are included in the curricula.

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THE INTERNATIONAL BIOTECHNOLOGY COURSE OF PERUGIA

An excellent example of a first and second degree biotechnology course, developed according to the Tuning principles, is the International Course of the University of Perugia.

The International First Level Degree in Biotechnology "Job Creation Oriented Biotechnology" is organised by the European University Consortium with the legal base in the University of Perugia, Italy.
The Consortium is established among the following Universities:

- Charles University Prague
- Polytechnic University of Valencia
- Rheinische Friedrich Wilhelms Universität Bonn
- University of Budapest
- University of Gdansk and
- Medical University of Gdansk
- University of Lecce
- University of Lisbon
- University of Perugia
- University of Turku
- University of Udine
- University of Sofia

with the aim to establish an European Degree in Biotechnology and to organise the International Degree Programme.

The objectives of the Consortium are:

- The selection procedure, enrolment and monitoring of students
- The definition of the teaching programme in accordance with the current European standards
- The organisation of the programme in modules, and the topics within the modules
- credit allocation and accumulation
- The choice of teachers from Universities and Industry
- The establishment of a data-bank of experts and specialists
- The definition of laboratory activities
- The direction of the laboratories devoted to practical activities
- The welfare of the students
- The choice of the modules and of the laboratories for thesis work
- Monitoring of currency, efficiency and validity of modules
- Monitoring of student assessment and performance
- The award of the degree

In addition it will oversee the promotion of research and collaborative research programmes, the creation of enterprises as a spin off from the project work, the promotion of scientific co-operation between Universities and enterprises, the promotion of job creation and the development of other co-operative projects.

The duration of the course "Job Creation Oriented Biotechnology" is three years. For admission, the students must possess the Diploma, or equivalent, of secondary school.
The number of students admitted is 40 and this number is divided between the Universities which select their students.
The official language of the course is English
Each module is formed by 1/3 of lectures and 2/3 of practical activities Students are invited to participate in 1 stage of 3 months during each of the summer periods of the first two years and are allowed to dedicate 6 months to the thesis preparation.
According to International rules, each student must develop, at least for one year, his/her formation in a country different to that in which she/he is enrolled as a student.
At the end of the stage the student must prepare a report which, if positively evaluated, will give the right to the student to obtain the additional credits. The student must prepare the thesis based on original work. After approval of the thesis supervisor, the thesis will be assessed by the supervisor and a member of the Teaching

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Committee who is not from the country of the student. When the Teaching Committee has approved the thesis, the student will be called to a viva voce by the Teaching Committee which will also participate in the evaluation.

Since the summer stages are outside of the taught programme, each successful stage will be recognised by awarding 15 credits over and above those (60) awarded for the taught programme.

At the end of the course, the student will obtain 180 (I-II-III year + thesis) + 30 credits (stages of I and II year).

The Diploma is signed by all partner Universities and it is valid in the countries to which the Universities pertain.

The International Master in Biotechnology "Biotechnology Medical Application" is also organised by the European University Consortium with the legal base in the University of Perugia, Italy.

The Consortium is established among the following Universities:

- University of Perugia
- University of Bonn
- University of Lecce
- University of Udine
- University of Gdansk and
- Medical University of Gdansk
- University of Budapest
- University of Oulu

with the aim to establish an European Master in Biotechnology and to organise the International Master Programme.

The objectives of the Consortium are:

- To extend the first degree course with a specialised master degree applying the same rules as for the "Job Creation Oriented Biotechnology"
- To prepare experts in diagnostic application in the identification of pathologies and in their treatment in animal and human
- Describe the structure and the content of the study programme in detail indicating the value of each part of the programme in ECTS credits
- Describe the role of each institution within the consortium in course delivery indicating which part of the programme is delivered by which institution

The duration of the course "Biotechnology Medical Application " is two years.

The number of students admitted will be maximum 40 and the professor/student ratio will be between 1-1.5 The official language of the course is English

The courses will be located at Perugia University, but will taught by teachers coming from all University countries and third countries.

Students must develop 1 stage of 6 months during the second semester of the first and the second year. The last will be useful to prepare the final thesis. The students must also follow seminars or short courses during their stages which will account, after evaluation, totally for 10 credits to be added to the fourth semester. At the end of the course, the student will obtain 120 (I°-II year + thesis) + 10 credits (stages)

The final Degree is signed by all partner Universities and it is valid in the countries to which the Universities pertain.

Both courses are conforming with the general and subject-specific competences, as with the knowledge outcomes for biotechnology as were delivered by the Tuning workforce.

The curriculum of the course: content, topics to be covered, structure (modules and credits), the educational units and activities to achieve the defined learning outcomes, the teaching and learning approaches, the methods of assessment, the evaluation system and the different parts of the programme in ECTS, are included in the detailed booklet of the International Course.

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