

BIOTECH-GO

Joint Study Education Programme (JSEP)

2016-1-BG01-KA202-023686

O3 BIOTECH-GO Joint Study Education Programme (JSEP)

This Intellectual output is dedicated on preparation and offer of multilingual blended modes of education and training in the field of bioinformatics. The JSE programme will be realized through Innovative VET training content in the following main topics:

I. Introduction to Bioinformatics

- Biology, biological databases, and high-throughput data sources
- Alignments and phylogenetic trees
- Omics and system biology

II. Bioinformatics/genomics in Biotechnology

- Health Bioinformatics
- Bioinformatics in food production and engineering
- The role of bioinformatics in agriculture
- Application of system biology in bioremediation

Part I Detailed Content

Biology, biological databases, and high-throughput data sources

Basic level:

- Introduction and application of modern bioinformatics in molecular biology. Components of bioinformatics. Basic concepts of molecular biology and computer abstractions. Information growth: sequences, genomes, macromolecular structures. Searching biological databases.

Advanced level:

- Exploitation of databases and data resources. Information about the use of boolean logic and formulation of boolean queries for searching purposes. Data annotation and data formats, the 3D molecular structure data, the DNA, RNA, and protein sequence data, genomic data, biochemical pathway data and gene expression data. Deposition of sequence and structure data into the public databases..

Part I Detailed Content

Alignments and phylogenetic trees

Basic level:

- Mechanisms of molecular evolution. Genefinders and DNA features detection. Sequences align. Global and local alignment. Approaches to search genomic database. Download of DNA and protein sequences from public databases. Features of BLAST. Multifunctional tools for sequence analysis – The Biology Workbench and EMBOSS.

Advanced level:

- Contemporary knowledge about multiple sequence alignment. Presentation of Clustal Omega. Basics of phylogenetic analysis and applicable software. The principle of profile- or motif-based analysis: use of data derived from multiple alignments to construct and search for sequence patterns.

Part I Detailed Content

Proteomics and system biology

Basic level:

- Tools for genomics and proteomics. Accessing genome information on the web. NCBI genome resources. Genome annotation. Functional genomics. Proteomics - experimental approaches and informatics challenges. Biochemical pathway databases – KEGG and PathDB.

Advanced level:

- Introduction of comparative genomics and recent advances in genome sequencing. Presentation of PEDANT, COGs, KEGG, and MBGD, as well as the organism-specific databases for *Escherichia coli*, *Mycoplasma genitalium*, *Bacillus subtilis*, and *Saccharomyces cerevisiae*.

Part II Bioinformatics/genomics in Biotechnology

Health Bioinformatics

- **Introduction To Health Bioinformatics.** Definition and overview of health informatics. Translational bioinformatics comprising information for Genomics in clinical care (Translational Genomics), Pharmacogenomics, Omics for drugs discovery and repurposing and Personalized genomic testing. Data is provided for Computational health informatics. Sensor and imaging informatics are described.

Additional information (*available at PTM for VET in Healthcare - Additional resources*)

- *Medical and Health Informatics* - content is dedicated on presentation of Clinical big data, Electronic health records (EHRs), Social health and Lifestyle environmental factors and public health.

Part II Bioinformatics/genomics in Biotechnology

Bioinformatics in food production and engineering

- **Bioinformatics benefits the food production and nutrition.** Applied bioinformatics approaches for food production and nutrition. Contribution of bioinformatics in reconstruction of metabolic pathways. The role of bioinformatics in improving the production of biomass and metabolites, enhancing crop production and food processing, and making better the food texture and flavour.
- **Bioinformatics in food quality & safety.** Contribution of bioinformatics in solving the major problems of food quality and safety. Bioinformatics approaches to manipulate the specific food characteristics effecting its quality. Application of bioinformatics in food risk assessment; tracing and detection of food microorganisms; and the impact of toxicogenomics on the food quality assurance. Major trends in bioinformatics implementation in food production, engineering and safety.

Part II Bioinformatics/genomics in Biotechnology

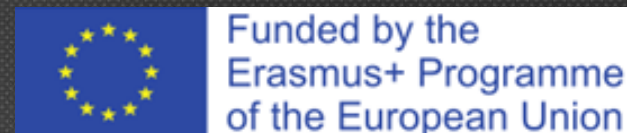
The role of bioinformatics in agriculture

- **Bioinformatics for agriculture.** Genomics, metabolomics and interactomics for sustainable agricultural development. Impact of genome sequencing in agriculture. Applications of agricultural bioinformatics. Agriculturally important biological database.
- **Plant genomics.** The role of model organisms. Managing and distributing plant genome data. Molecular plant breeding. Rational plant improvement. Genotype building experiments. QTLs (Quantitative Trait Locus) analysis and mapping.

Part II Bioinformatics/genomics in Biotechnology

Application of system biology in bioremediation

- **Introduction to Bioremediation.** Types of organisms used in bioremediation. Brief overview on bioremediation strategies and existing *in situ* and *ex situ*. Advantages and disadvantages of bioremediation techniques. Influence of environmental factors on biodegradation process.
- Application of **Systems biology, Metagenomics and Metatranscriptomics – Metaproteomics - Metabolomics** in environmental remediation.
- Several specific **Case Studies** are also provided.



BIOTECH-GO training modes

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BIOTECH-GO training modes

- The development of the BIOTECH-GO JSEP Learning modes is based on the design of ***Personalized Training Modules*** (PTMs):
- ***Why Modular (personalized) education?*** - Modular content refers to a collection of learning resources developed as a single learning object. Each learning object functions like a building block independent and self-contained but capable of being paired with other building blocks.
- Each PTM is offered for: ***Distance*** or ***Part time education***

Distance and Part-time Education

Ensures skills level ranging from functional/work place literacy programmes to advanced technical skills delivery within institutional and workplace context and training for both unemployed and employed participants.

- ✓ Flexible – trainees work where and when they choose to fit in with jobs, families and other commitments
- ✓ All-inclusive – trainees get all the high quality materials they need to study
- ✓ Supportive – personal tutors provide academic expertise, guidance and feedback and run group tutorials; and specialist advisers are on hand to help with other aspects of study
- ✓ Social – trainees get together through tutorials, online conferencing, study networks and course forums.

Part-Time Studies and Distance Learning in a Nutshell

Part-time Studies

- Trainees get to study towards a specific qualification with more flexibility regarding study time and fee payments.
- Like full-time students, part-time learners generally also attend lectures, complete assignments, and write exams – it's just all spread out over a longer duration with a less rigid schedule.
- Duration, cost, lecture times, and all those details, are specific to each institution and training programme.

Distance Learning

Distance Learning, or correspondence learning, is designed for learners who wish to study towards a specific qualification in their own time completely, without the standard procedure of attending lectures and classes.

Methodology applied

Trainee can contact the tutor by:

- ✓ Telephone or email
- ✓ Video Conference (VC)
- ✓ Audio Conference (AC)
- ✓ Virtual Learning Environment (VLE)
- ✓ Work Placements
- ✓ Evening and Part-time Certified Training

BIOTECH-GO training modes

- Development of the BIOTECH-GO JSEP Training modes - design of ***Personalized Training Modules*** (PTMs):

PTM	Target group / End-users
PTM in General Bioinformatics (basic and advanced level)	VET Professionals working in the area of Biotechnology
PTM in Healthcare	VET Professionals in Healthcare
PTM in Agriculture	VET Professionals in Agriculture
PTM in Food science	VET Professionals in Food Science
PTM in Environmental science	VET Professionals in Environmental science

- Each PTM is offered as: ***Distance*** or ***Part time education***

BIOTECH-GO JSEP structure

Delivery of training material comprising 2 main training directions:

✓ ***General part*** introducing basic concepts of bioinformatics science

I. Introduction to Bioinformatics – PTM1 and PTM2 (basic and advanced level)

- Biology, biological databases, and high-throughput data sources
- Alignments and phylogenetic trees
- Omics and system biology

✓ ***Specific part*** dedicated on the application of bioinformatics in different biotechnological sectors

II. Bioinformatics/genomics in Biotechnology

PTM3: Health Bioinformatics

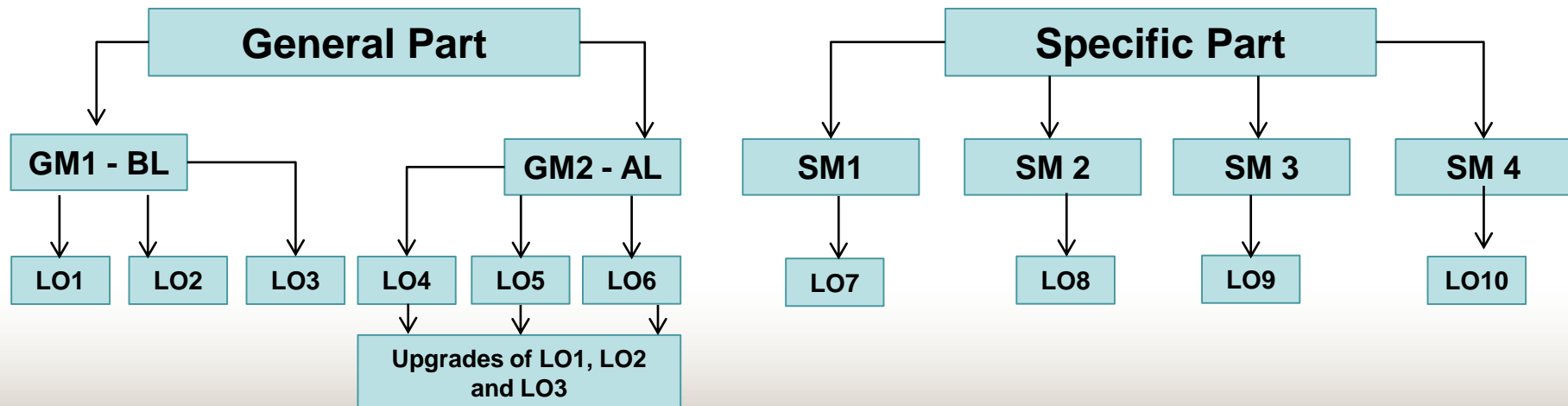
PTM4: Bioinformatics in food production and engineering

PTM5: The role of bioinformatics in agriculture

PTM6: Application of system biology in bioremediation

BIOTECH-GO JSEP structure

- **General part** of the JSEP forms two Personalized Training Modules, each composed from 3 LOs (Basic and Advance level in Bioinformatics)
- **Specific part** of the JSEP is organized in 4 different Personalized Training Modules (depending on the sector dedicated on) and each Module comprises 1 LO.



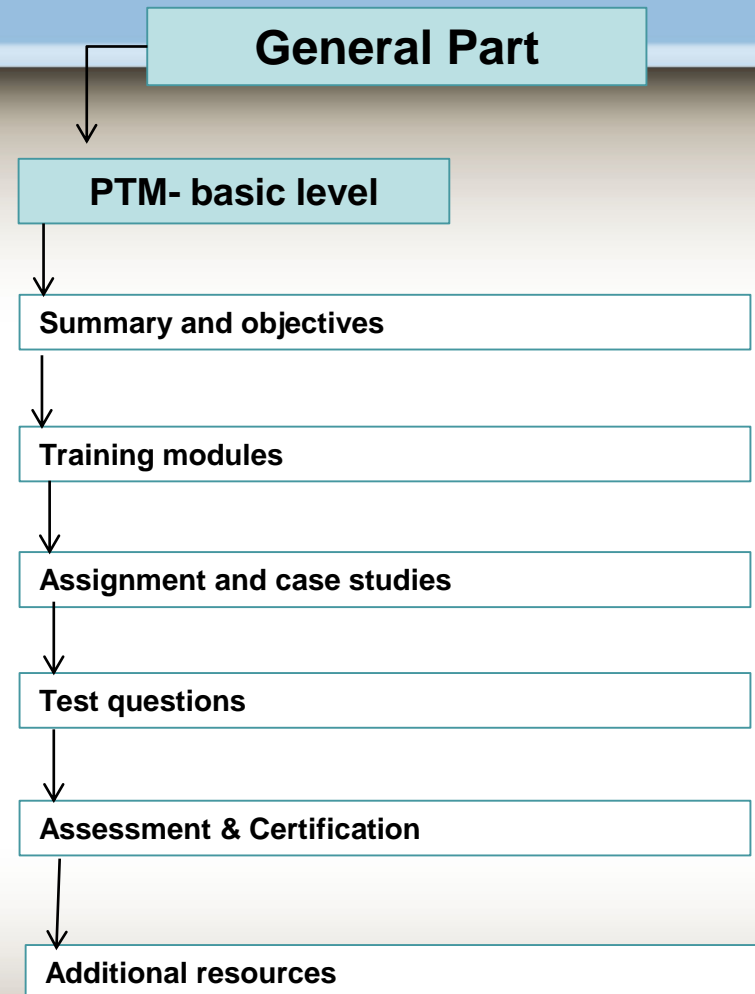
Enrollment level – structure and organization

- Description of the required background of a trainee to be enrolled in the BIOTECH-GO JSEP
- Described for both BIOTECH-GO levels – Basic and Advanced
- Composed from several elements
 - ***Knowledge & Skills in defined subject area***
 - ***Responsibility and autonomy (former Wider competence)***

BIOTECH-GO Components of the PTM

Each PTM has the following elements:

- An introduction to the module's objectives, its rationale or purpose, and context – brief summary.
- Learning content, dedicated on the main topics in the specific educational area
- Opportunities to practice, apply, analyze or synthesize new information - include worked or practice exercises, or case studies.
- Self-assessment part for evaluating the end-users learning and progress
- Additional resources for trainees to extend their learning through enriching activities and evaluation.



Summary and objectives

- Specifying the main ideas of the text
- Reflecting the proportionate coverage and giving various points in the original text
- Indicating what is the purpose of the training material provided

Training modules – structure & organization

Menu organized in 3 subparts

➤ *The on-line training content*

LO1: Biology, Bioinformatics Approaches and Biological Databases

LO2: Bioinformatics Tools for Sequence Analysis

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LO10:

➤ *References*

➤ *Module authors*

Assignment and case studies – structure and organisation

- For each PTM – 2 Case studies are presented
- Available in EN and BG languages
- Practical example on how bioinformatics could be applied in the relevant scientific field, presented as ppt

Example for PTM in Healthcare:

Case study 1: In silico drug design

Case study 2: In silico evaluation of anti-pathogenic targets

Test questions – structure and organization

- Each PTM ends with set of (self)assessment questions
- Type of question – Multiple choice and True/False
- The set includes:
 - 10 questions for GMs** – basic and advanced level
 - 15 questions for SMs** – 10 questions from the General part and 5 questions from the Specific part
- The set of test questions is selected at random from a predefined pool
- Available final report on performed test

Assessment & Certification – structure and organization

- For each PTM, a scheme for Assessment & Certification is proposed
- For each PTM, 2 types of learning are foreseen:
 - ***Part-time Training***
 - ***Distance Training***
- Assessment scheme contains several elements:
 - ***Learning duration of the PTM***
 - ***Proposed time schedule***
 - ***Total time necessary to accomplish the training***
 - ***Final credit points acquired***

BIOTECH-GO Certificate

- At the end of assessment scheme, a specific certificate for the relevant PTM is provided
- Certificate elements:

PROFILE OF KNOWLEDGE, SKILLS & COMPETENCES ACQUIRED DURING THE BIOTECH-GO TRAINING

Knowledge & Skills

Responsibility & Autonomy

OFFICIAL BASIS OF THE BIOTECH-GO CERTIFICATE

Name and status of the body awarding the certificate

Level of the certificate

Credit points awarded

Access to next level of education/training

Grading scale / Pass requirements

International agreements – if available!