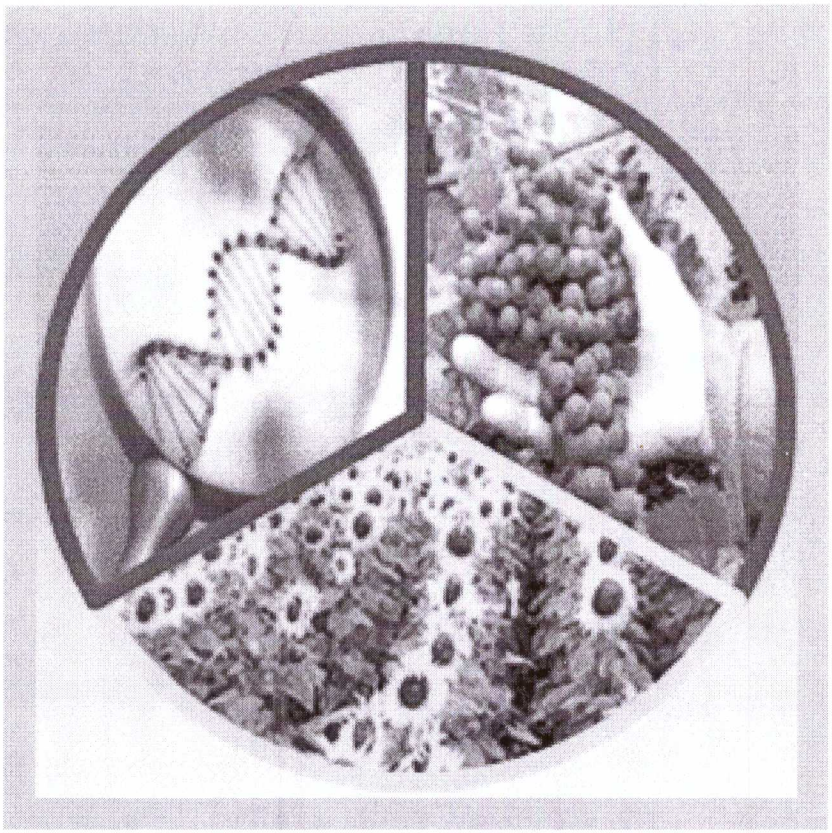
დამტკიცებულია 22.07.2011

IV. JAVAKHISHVILI TBILISI STATE UNIVERSITY
FACULTY OF EXACT AND NATURAL SCIENCES
DEPARTMENT OF BIOLOGY

MASTER PROGRAM
"APPLIED BIOSCIENCES"



Tbilisi
2011

I. MASTER PROGRAM TITLE : Applied Biosciences"

II. ACADEMIC DEGREE : M.Sc. in Applied Biosciences (Biotechnology)

III. PROGRAM DIRECTOR (CV – see appendix I)

Nino Inasaridze - PhD, Coordinator of TEMPUS project "MAPB" (#159340 Tempus-1-2009-1-ES-Tempus-JPCR - "MAPB"), "MSc in Applied Biosciences" Program Director

IV. ANALOGICAL REPRESENTATIONS OF PROGRAM

M.Sc. in Applied Biosciences:

University of East London

http://www.uel.ac.uk/hab/programmes/postgraduate/biosciencemsc.htm

University of Leeds - West Yorkshire

http://www.leeds.ac.uk/coursefinder/17203/MSc_Bioscience_(Biotechnology)

Cork Institute of Technology

http://www.cit.ie.course?id=604

V. PROGRAM OUTLINE

A new Master's degree program in Applied Biosciences has been designed at the Faculty of Exact and Natural Sciences, Tbilisi State University, within the framework of the TEMPUS Project ((#159340 Tempus-1-2009-1-ES-Tempus-JPCR - "MAPB") in partnership with other local, regional and European Universities, such as Akaki Tsereteli State University, Georgian State Agrarian University, Yerevan State University, Armenian State Agrarian University, University of Alicante (Spain), University of West of England, Aristotle University of Thessaloniki, Consulting Company P&B (Portugal).

The program meets the TSU development and HEI reform strategy and priorities. The student-oriented program with a modular approach to teaching includes four strands in Healthcare, Food, Environment and Agricultural Biotechnology. The program envisages the control of European standards for academic quality, program management and program accreditation. By intensive use of computer-based technologies the program will provide introduction of modern teaching methodologies (including online e-learning) and scientific investigations relevant to today's standards.

The program offers specialization courses designed to prepare high-qualified professionals in applied biosciences and biotechnology as well as narrow-profile specialists in the spheres of their interest. A large number of subjects are newly designed, aimed to be economical and flexible. The curriculum covers different aspects of applied biosciences and biotechnology, such as key concepts and advances in applied biosciences; legislative, commercial and ethical principles, and biosecurity issues. After completion of the program, the graduates will gain in-depth theoretical and practical knowledge in the subjects taught, as well as general and specific skills, required for further successful scientific or other carreer. The program also offers students the course in Field Specific English that will help students to improve their knowledge with an emphasis to learning scientific terms and phrases, that is of extreme importance today, when English obviously dominates in modern scientific society.

Healthcare Biotechnology

Healthcare Biotechnology is one of the most rapidly developing interdisciplinary areas of Applied Biosciences. Recent advances in biology have generated new insights into the causes of disease and revealed the potential to improve health care by the development of new therapies, diagnostic tools, production of drugs and innovative medicines, etc. The Healthcare Biotechnology strand aims to give deep understanding of the biotechnological tools used in molecular biology with an emphasis on medical applications. It concentrates on biological processes and technologies, scientific and practical

basis of biotechnology as applied in support of medicine, preparing the students for good job opportunities and making them attractive to potential employers.

Students of Healthcare Biotechnology strand will gain advanced knowledge of genome sciences; principles of clinical pharmacology; biodiversity and human health; methods used in clinical diagnostics, particularly in: clinical biochemistry, cytogenetics, cytodiagnostics, hystodiagnostics, hematology and transfusiology; skill sets used in the research, design and development of pharmaceutical products for medical industry. The students will also gain the regulatory and ethical framework with relationship to medical biotechnology.

Combination of the subjects taught in the Healthcare Biotechnology strand gives wide profile for a professional career in biotechnological industry, clinical/diagnostic centers, analytical services, pharmacological and pharmaceutical companies, scientific-research institutions or for further academic studies. All students with a Master in Applied Biosciences degree are admissible to a PhD program.

Food Biotechnology

The main goal of the Food Biotechnology strand is to give students systemic knowledge of the main principles and tendencies in the food biotechnology. The course will cover the topics in physical-chemical properties of food and food raw material; food compound determination and identification methods; principles of food processing; food microbiology; food toxicology and allergy; food expertise, standartization and certification issues, etc. The modules will serve to equip students with the in-depth knowledge of food safety and control; risk assessment and risk-management; the regulations and legislative base in EU and in Georgia. Students will learn a range of fundamental as well as modern express methods of food laboratory analysis. During laboratory work students will acquire practical methods, including taking food samples, preparations for food transportation and analysis; detection of physical, chemical and biological (microbial) contamination; quantitative and qualitative analysis of indicative microorganisms; evaluation of hazards, risk-assessment and risk-management.

After the successful completion of the course students will have the employment opportunities in food safety and expertise services; food producing and agricultural profile companies; food auditing and consulting companies; scientific-research institutes and laboratories. Alternatively graduates might apply for post-graduate doctoral programs locally or abroad.

Environmental Biotechnology

Environmental Biotechnology encompasses the biotechnological approaches applied to the management of environmental problems. Environmental Biotechnology strand is designed to train Master students for careers in new and growing areas of the life sciences emphasizing the use of biotechnology in agriculture, environmental clean-up and management. The strand offers brand new courses for the first time implemented in Master programs in biology. The course will cover the issues on biotechnology in environmental protection and biodiversity conservation; biotechnologies in treatment of wastes; topics in environmental health; environmental legislation, strategies and policies. The employment opportunities for the graduates will include agencies of protected areas; inspection of environment protection; Forestry Agency; National Environment Agency; governmental and nongovernmental organizations of environment protection; universities and research institutes.

Agrobiotechnology

The Agrobiotechnology is linked to a sector that is very important to the international economy. The program aims to impact understanding of the basic principles of agricultural sciences and molecular biology and of the integration of these disciplines to provide healthy crops and livestock in a safe environment for food and non-food applications. The goal of the program is to deliver the main

achievements in Agrobiotechnology and information about biotechnologies in plant science, animal reproduction, and microbial biotechnology; the legal and ethical aspects of agricultural technologies clarifying how laws and public policy affect food production in developed and developing countries and the environment.

Graduates are university-trained professionals who are able to contribute to the sustainable development of plant and animal production at various integration levels, based on their knowledge of fundamental and applied sciences and their interdisciplinary approach. Graduates with a research focus are employed at universities, research institutes and biotech or agribusiness companies. Other job opportunities can be found in management, policy, consulting and communication in agrobusiness and governmental and non-governmental organizations.

PROGRAMME GOALS AND OBJECTIVES:

The programme aims to:

- Provide course of study which meets the standards of TSU Quality Assurance Office and the National Center for Educational Quality Enhancement;
- Award students with Master degree which meets the criteria of Ministry of Education and Science;
- Produce qualified specialists in multidisciplinary field of applied biosciences. On the basis of four strands' modules (in Healthcare Biotechnology, Food Biotechnology, Agrobiotechnology and Environmental Biotechnology) the program aims to equip students with the fundamental knowledge in core disciplines of biosciences such as Genomics; Microbial Techniques; Applied Toxicology; Principles of Biosecurity; Legislative, Ethical and Commercial Principles of Biosciences, as well as in specialized areas of Healthcare Biotechnology, Food Biotechnology, Agrobiotechnology and Environmental Biotechnology;
- Produce qualified specialists with the ability to apply their knowledge and understanding in practice; to act adequately in new multidisciplinal environment; to handle complex problems by means of innovative original approaches; to conduct independent research by using modern approaches and techniques;
- Produce graduates who have a range of core skills including: the ability to formulate judgements with incomplete or limited information, reflecting on social and ethical responsibilities; the ability to extract, critically analyze, and innovatively synthesize information; the ability to communicate the data and conclusions to specialist and non-specialist audiences clearly and unambiguously; learning skills to continue to study in a manner that may be largely self-directed or autonomous; the ability to evaluate attitude towards values and participate in creation and implementation of new values;
- Prepare qualified specialists with the knowledge and skills suitable for: subject-related career in research, teaching or management in educational and research institutions, industry or government agencies; general careers with the emphasis on non-subject-specific skills or to continue more advanced studies.

PROGRAMME OUTCOMES:

LEARNING OUTCOMES
KNOWLEDGE AND UNDERSTANDING:
A1 knowledge in research design and methodology; knowledge of statistical methods;

systemic knowledge of legislative, commerial and ethical principles of biosciences. A2 in-depth and systemic knowledge of fundamental disciplines of Applied Biosciences (Genomics; Microbial Techniques; Applied Toxicology; Principles of Biosecurity, etc). A3 fundamental knowledge of field-specific subjects in Healthcare Biotechnology, Food Biotechnology, Environmental Biotechnology and Agrobiotechnology.
APPLYING KNOWLEDGE IN PRACTICE B1 identification of complex problems and problem solving abilities in new or unfamiliar environments within multidisciplinary contexts related to the field of applied biosciences. B2 independent research by using modern approaches and methodology.
MAKING JUDJEMENTS C1 the ability to formulate judgements on the basis of incomplete or limited information, including social and ethical responsibilities linked to the application of knowledge and judjements. C2 the ability of innovative synthesis of information.
COMMUNICATION D1 the ability to present the conclusions and the knowledge, and communicate with specialist and non-specialist audiences clearly and unambiguously.
LEARNING SKILLS E1 the ability to continue learning independently; understanding of learning process and strategy planning.
VALUES F1 the ability to elaborate attitude towards values and participate in creation and implementation of new values.

EMPLOYMENT OPPORTUNITIES:

The graduates of the program have a wide range of employment opportunities. The potential employers of the MSc Applied Biosciences graduates include scientific research laboratories, clinical laboratories and diagnostic centres, pharmacological and pharmaceutical companies, analytical services, agroindustry, food processing, supply, safe and sale services, etc. Along with the subject-related career in research, teaching or management in industry or government agencies the graduates can follow general careers with the emphasis on non-subject-specific skills.

LEARNING CONTINUATION PROSPECTS:

The graduates of the MSc Applied Biosciences program can continue more advanced studies and apply for post-graduate doctoral programs in Georgian as well as foreign higher educational institutions.

VI. ENTRY REQUIREMENTS

Admission to the Master's program "Applied Biosciences" meets the general TSU graduate admission requirements.

Who can enroll on the MSc "Applied Biosciences" programme :

1. Applicants should have a bachelor's degree diploma (or qualifications recognised as equivalent) in a relevant field: Biology, Applied Biology/Biosciences, Life Sciences, Natural Sciences, Biomedicine, Medicine, Psycology, Ecology, Environmental Sciences, Agrarian/Agricultural Sciences.

2. Applicants with a bachelor's degree diploma (or qualifications recognised as equivalent) who have passed Minor Programs in Biology or Applied Biology/Biosciences.

Additional Admission Requirements for the Program:

- For admission to the Program, the knowledge of English at B2 level is desirable. All applicants will be interviewed by the program director and program board members.

Among competing applicants, preference will be given to those who have participated in scientific conferences, trained at international schools or overseas universities, had professional experience in relevant or adjacent fields that meets the demands of the degree.

VII. PROGRAM STRUCTURE

The program lasts **2 years (4 semesters).**

The program covers 120 ECTS* (60 ECTS per year, 30 ECTS per semester)

The program includes four strands:

- Healthcare Biotechnology
- Food Biotechnology
- Environmental Biotechnology
- Agrobiotechnology

Semester I of the program includes common core modules.
Semester II and III include common core modules as well as optional modules of strands.
Semester IV is dedicated to the MSc research project.

* 1 ECTS = 25 working hours

Program structure

Semester I	ECTS	Semester II	ECTS
Common Core Modules	30	Common Core Modules Optional Modules	20 10
Semester III	**ECTS**	**Semester IV**	**ECTS**
Common Core Modules Optional Modules	10 20	Research project	30

Modular Distribution

Semester I	
Common Core Modules 30 ECTS	1. Research Design and Methodology - 10 ECTS 2. Advances in Applied Biosciences – 10 ECTS 3. Genome Science (Genomics) – 5 ECTS 4. Field Specific English – 5 ECTS
Semester II	
Common Core Modules 20 ECTS	1. Microbial Technology - 5 ECTS 2. Applications of Toxicology – 5 ECTS 3. IPR, Legislative, Commercial and Ethical Principles of Biosciences - 5 ECTS 4. Field Specific English – 5 ECTS

Optional Modules 10 ECTS	*Health Biotechnology:* 1. Key Concepts in Healthcare Biotechnology – 10 ECTS *Agrobiotechnology:* 1. Agricultural Biotechnology - 5 ECTS 2. Agrobiodiversity, Biotechnology and Sustainablity – 5 ECTS *Food Biotechnology:* 1. Fundamentals of Food Chemistry – 5 ECTS 2. Food Microbiology – 5 ECTS *Environmental Biotechnology:* 1. Biotechnology in Environmental Protection and Biodiversity Conservation –10 ECTS
III სემესტრი	
Common Core Modules 10 ECTS	1. Principles of Biosecurity – 5 ECTS 2. Public Health Nutrition – 5 ECTS
Optional Modules 20 ECTS	*Health Biotechnology:* 1. Methods in Clinical Diagnostics: Clinical Biochemistry, Hematology and Transfusion Science – 10 ECTS 2. Methods in Clinical Diagnostics: Cytogenetics, Cytodiagnostics and Histodiagnostics – 10 ECTS 3. Principles of Clinical Pharmacology -5 ECTS 4. Biodiversity and Human Health – 5 ECTS 5. Topics in Environmental Health – 5 ECTS *Agrobiotechnology:* 1. Plant Tissue Culture and Micropropagation – 5 ECTS 2. GMOs/LMOs Food and Environmental Safety - 5ECTS 3. Alternative Agriculture – 5 ECTS 4. Biodiversity and Human Health – 5 ECTS *Food Biotechnology:* 1. Food Processing and Fermentation Technology – 5 ECTS 2. Food Safety and Quality – 5 ECTS 3. Food Toxicology and Allergy – 5 ECTS 4. Food Expertise, Standardization and Certification -5 ECTS 5. Methods of Food Analysis – 5 ECTS (TSU) 6. GMOs/LMOs Food and Environmental Safety - 5 ECTS *Environmental Biotechnology:* 1. Environmental Chemistry and Methodologies in Environmental Monitoring – 5 ECTS 2. Environmental Legislation, Strategies and Policies – 5 ECTS 3. Biotechnologies for Treatment of Wastes – 5 ECTS 4. Biodiversity and Human Health – 5 ECTS 5. Topics in Environmental Health – 5 ECTS
Semester IV	
Research and Master Thesis 30 ECTS	

N	MODULE TITLE (CONTACT HRS/INDEPENDENT WORK HRS)	ECTS	SEMESTER			
			I	II	III	IV
COMMON CORE MODULES						
1	Research Design and Methodology (90/160)	10	10			
2	Advances in Applied Biosciences (120/130)	10	10			
3	Genome Science (45/80)	5	5			
4	Field Specific English (120/130)	10	5	5		
5	Microbial Technology (45/80)	5		5		
6	Applications of Toxicology (45/80)	5		5		
7	IPR, Legislative, Commercial and Ethical Principles of Biosciences (45/80)	5		5		
8	Principles of Biosecurity (45/80)	5			5	
9	Public Health Nutrition (45/80)	5			5	
OPTIONAL MODULES						
HEALTHCARE BIOTECHNOLOGY						
1	Key Concepts in Healthcare Biotechnology (90/160)	10		10		
2	Methods in Clinical Diagnostics: Clinical Biochemistry, Hematology and Transfusion Science (90/160)	10			10	

3	Methods in Clinical Diagnostics: Cytogenetics, Cytodiagnostics and Histodiagnostics (90/160)	10			10	
4	Principles of Clinical Pharmacology (45/80)	5			5	
5	Biodiversity and Human Health (45/80)	5			5	
6	Topics in Environmental Health (45/80)	5			5	
FOOD BIOTECHNOLOGY						
1	Fundamentals of Food Chemistry (45/80)	5		5		
2	Food Microbiology (45/80)	5		5		
3	Food Processing and Fermentation Technology (45/80)	5			5	
4	Food Safety and Quality (45/80)	5			5	
5	Food Toxicology and Allergy (45/80)	5			5	
6	Food Expertise, Standardization and Certification (45/80)	5			5	
7	Methods of Food Analysis (45/80)	5			5	
8	GMOs/LMOs Food and Environmental Safety (45/80)	5			5	
AGROBIOTECHNOLOGY						
1	Agricultural Biotechnology	5		5		

	(45/80)					
2	Agrobiodiversity, Biotechnology and Sustainablity (45/80)	5		5		
3	Plant Tissue Culture and Micropropagation (45/80)	5			5	
4	GMOs/LMOs Food and Environmental Safety (45/80)	5			5	
5	Alternative Agriculture (45/80)	5			5	
6	Biodiversity and Human Health (45/80)	5			5	
ENVIRONMENTAL BIOTECHNOLOGY						
1	Biotechnology in Environmental Protection and Biodiversity Conservation (90/160)	10		10		
2	Environmental Chemistry and Methodologies in Environmental Monitoring (45/80)	5			5	
3	Environmental Legislation, Strategies and Policies (45/80)	5			5	
4	Biotechnologies for Treatment of Wastes (45/80)	5			5	
5	Biodiversity and Human Health (45/80)	5			5	
6	Topics in Environmental Health (45/80)	5			5	
RESEARCH PROJECT		30				30

VIII. MODULE SYLLABI (see appendix 2)

IX. RESEARCH

The research component of the program is focused on a Master's thesis. The choice for the research project will be made in correspondence with the selected strand (Healthcare Biotechnology, Food Biotechnology, Environment Biotechnology or Agro Biotechnology).

The students can do their Master's thesis in the laboratory for the Applied Biosciences Program students; at different streams of Biology Department; in partner universities; in the institutions and organizations that have signed Memorandum of Understanding with TSU, etc.

To select a theme for Master's thesis, the students will be proposed the list of topics for Master's thesis research approved by the Program Management Committee.

The Master's thesis must be a completed scientific work that gives comprehensive outline of the subject matter and displays the student's knowledge and capability to independently identify and analyze problem area; formulate and discuss actual issues; critically evaluate the literature relevant to the issue. The experiments should be done with appropriate scientific accuracy. The student must be able to analyse and interpret the results, to apply statistical methods, to visualize the results using computer programs, to discuss and present adequate conclusions. The thesis must be submitted in the appropriate format and defended in a public presentation in the presence of exam commission. The student must demonstrate the ability to argue and defend his/her findings. The thesis must be accompanied by the written reviews submitted by the thesis supervisor and the reviewer.

X. MATERIAL AND TECHNICAL BASIS FOR THE SCIENTIFIC RESEARCH WORK

The Master's degree students will conduct scientific-research work in:

- The well-equiped laboratory, functioning as a basis for the MSc programme "Applied Biosciences", as well as for BSc programme "Applied Biosciences and Biotechnology".

  The following modern equipment and devices have been purchased for this purpose:
  - **DNA Gel Electrophoresis Apparatus** for extraction and analysis of DNA fragments
  - **Polymerase Chain Reaction (PCR) Apparatus**: Thermocycler, Vertical Electrophoresis, Transiluminator
  - **Laminar Boxes** for Tissue Cultures
  - **Thermostat with CO_2 and Dry Air Thermostat**
  - **Autoclave Apparatus** for sterilizing objects
  - **ELIZA for immunenzimatic reactions**
  - **Other lab facilities:** Analytical, Technical Scales; pH-meter; Photoelectric Colorimeter, Centrifuges; Eppendorf Pipettes

The Lab is designed to familiarize students with modern techniques applied in molecilar biology and biotechnology. The students will acquire knowledge in using molecular genetic research methods; physical-chemical, immunological, histological, morphological and other diagnostic technologies; microbiological testing methods; in particular: Polymerase Chain Reaction (PCR) method; human, animal and plant cell culturing for application in different *in vitro* experiments; working with HPLC –

High Performance Liquid Chromatography and other chromatographic systems for medical-pharmaceutical purposes, as well as in agricultural and food biotechnology.

- **Other scientific-teaching laboratories at different divisions of the Department of Biology, including:**

  - Laboratory of Human and Animal Physiology
  - Laboratory of Biodiversity
  - Laboratory of Biophysics
  - Laboratory of Genetics
  - Laboratory of Immunology and Microbiology
  - Laboratory of Morphology
  - Laboratory of Physical and Chemical Biology
  - Jandara Laboratory

- **In the partner universities; in the institutions and organizations that have signed Memorandum of Understanding with TSU, etc.**

The Master's degree students are encouraged to use computer classes and internet facilities for seeking information; use the Hinari program, that gives the students free access to the leading worldwide scientific journals and other scientific electronic resources.