STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus Gedimino technikos universiteto

# NANOBIOTECHNOLOGIJOS STUDIJŲ PROGRAMOS (621J70003)

# VERTINIMO IŠVADOS

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# EVALUATION REPORT

# OF *NANOBIOTECHNOLOGY* (621J70003)

# STUDY PROGRAMME

at Vilnius Gediminas Technical University


| | |
|---|---|
| Grupės vadovas:<br>Team leader: | Prof. Maris Klavins |
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Išvados parengtos anglų kalba
Report language - English


Vilnius
2014

## DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

| | |
|---|---|
| Studijų programos pavadinimas | ***Nanobiotechnologija*** |
| Valstybinis kodas | 621J70003 |
| Studijų sritis | Technologijos mokslai |
| Studijų kryptis | Biotechnologijos |
| Studijų programos rūšis | Universitetinės studijos |
| Studijų pakopa | Antroji |
| Studijų forma (trukmė metais) | Nuolatinė (2) |
| Studijų programos apimtis kreditais | 120 |
| Suteikiamas laipsnis ir (ar) profesinė kvalifikacija | Biotechnologijų magistras |
| Studijų programos įregistravimo data | 2011-05-24, 1-01-61 |

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## INFORMATION ON EVALUATED STUDY PROGRAMME

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|---|---|
| Title of the study programme | ***Nanobiotechnology*** |
| State code | 621J70003 |
| Study area | Technology Sciences |
| Study field | Biotechnologies |
| Kind of the study programme | University Studies |
| Study Cycle | Second |
| Study mode (length in years) | Full-time (2) |
| Volume of the study programme in credits | 120 |
| Degree and (or) professional qualifications awarded | Master of Biotechnologies |
| Date of registration of the study programme | 2011-05-24, 1-01-61 |

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# I. INTRODUCTION

The procedures of the external assessment of the study programmes were initiated by the Centre for Quality Assessment in Higher Education of Lithuania nominating the external assessment peer group formed by the head, professor Maris Klavins (University of Latvia, Latvia), professor Kari Keinänen (University of Helsinki, Finland), professor Arthur J. Ragauskas (Georgia Institute of Technology, USA) and Dr. Egidijus Vladas Baškys, employer representative (Agency for Science, Innovation and Technology, Lithuania), and Raimonda Celiešiūtė, student representative (Vilnius University, Lithuania).

For the evaluation of the study programme the documents, regulating assessment were used (Methodical Guidelines for Experts; Regulations for Undergraduate, Specialised Professional and Integrated Study Programmes, Description of General Requirements for Master's Study Programmes; Description of Study Programme Accreditation Order.

The basis for the evaluation of the study programme (hereafter, the programme) is the Self-Assessment Report, written in 2013, its annexes and the site visit of the expert group to the Vilnius Gediminas Technical University (hereafter, the University; VGTU) on 5th March 2014. The visit incorporated all required meetings with different groups: the administrative staff of the Department of Chemistry and Bioengineering of the Faculty of Fundamental Sciences, staff responsible for preparing the self-assessment documents, teaching staff, students of all years of study, graduates, and employers (one person). The expert group inspected various support services (classrooms, laboratories, library, computer facilities), examined students' final works, and various other materials. After the expert group discussions and additional preparations of conclusions and remarks, introductory general conclusions of the visit were presented. After the visit, the group met to discuss and agree the content of the report, which represents the expert team consensual views.

Mission of the VGTU is to provide studies in engineering field. The unit responsible for a running of the second level study programme "***Nanobiotechnology***" is the Department of Chemistry and Bioengineering of the Faculty of Fundamental Sciences and Research laboratory "*Bioinformatics*". The realisation of the study programme is done in close cooperation with other units of the VGTU and Vilnius University and research institutes attracting highly qualified lecturers and scientists.

# II. PROGRAMME ANALYSIS

## *1. Programme aims and learning outcomes*

The proposed learning outcomes of VGTU's programme titled „NanoBiotechnology" as stated in the review material is: "The major aim of the Nanobiotechnology study programme is to make students acquainted with principles of nanotechnologies and their application in biotechnologies, biomedicine and engineering of biological structures. To achieve the major aim of the programme, four key tasks have been formulated to cover all activity areas of Masters of Nanobiotechnology that are integrally associated with each other and ensure the systemic integrity of the programme:

- To consolidate theoretical foundations and practical skills of common basics and study subjects.
- To develop planning skills of stand-alone scientific research.
- To introduce principles of scientific information processing and experimental data evaluation.
- Train junior specialists, who are able to plan stand-alone experiments and work in laboratories."

The review committee clearly found a very strong and dynamic programme as it applies to the medical biotechnology but the strength in the nanosciences was not as equally apparent. Indeed, only one course (Diagnostic nanobiotechnology) rigorously incorporates concepts of nanotechnologies into the learning experience and the committee had concerns about how rigorous the fundamentals of nanotechnology were developed in this programme. Likewise, the amount of nanotechnology research facilities at VGTU was wanting and although this may be supplemented with facilities at Vilnius University the committee was not given an opportunity to inspect the latter facilities. From discussions with students and social partners, the reported learning outcomes were well supported. The overall generic outcomes were certainly consistent with generally expected outcomes of a graduate MSc programme. Furthermore, the educational outcomes and research infrastructure/experience in the medical biotechnology was viewed as unique and certainly worthy of continued programme support. One learning aspect that was not sufficiently developed and that the committee strongly believes needs further attention is the ethical responsibilities in biotechnology. Given the broad impact that biotechnology and medical sciences may have in society it is important that students are trained in the acceptable ethical norms by which one conducts research and development in biotechnology. This issues needs to be addressed in the near future. The VGTU self-study also highlighted the diverse strengths and weaknesses of incoming students which needs to be addressed by improved recruiting efforts and provide additional tutorial support for incoming students. Finally, the administration and staff of this programme need to address issues associated with the current programme name as the whole committee believes that the current name "Nanobiotechnology" is misleading because of insufficient content on this area. Either the VGTU staff and administration provide a substantial increase in learning experiences about nanotechnology or rename the programme to be more reflective of the current programme curriculum and its projected learning outcomes.

### *2. Curriculum design*

The duration of the programme (four semesters, 120 ECTS), and the volumes (in ECTS) allocated to study field subjects (62), and elective studies (12), and the number of subjects per semester (5 or less) are in agreement with the legal requirements. The courses are evenly distributed between the four semesters (30 ECTS per semester). The course descriptions in the SER (Appendix 1) indicate some overlap between the courses "Stem cell biology" and "Cellular technology" both in aims and content.

Multiple teaching/learning are employed. The courses can consist of lectures, laboratory practices, exercises and consultations. Almost all courses have 30 hours of lectures and four hours of consultations with the teacher. The majority of courses have either 15 hours of laboratory practices or 15 hours of problem-based exercises. Most courses are compulsory

leaving very little space for elective courses to be chosen based on the students´ personal interests: the students have a choice between "Nanomedicine" and "Industrial biotechnology" in the 2nd semester of the first year, and a free choice of one 6 ECTS course in the 1st semester of the second year. During the site visit, it turned out that the Nanomedicine course was not arranged this year, further diminishing the possibilities for free choice. A wider selection of elective courses could increase student motivation, a view shared by the students. There is no course on bioethics, often an integral part of biotechnology curricula. The curriculum would benefit from inclusion of a course which would familiarize the students with ethical questions related to the use and development of biotechnology and with research ethics (e.g., good research and publication practises).

The programme is strongly biased towards medical biotechnology (48 ECTS of the study subjects are linked to biomedical topics or applications), and there are only two courses (Nanomedicine and Diagnostic nanobiotechnology), which, according to course descriptions, specifically explore the nanotechnological dimension of biotechnology. Therefore, it may be questioned whether the title of the programme is consistent with its content. Also, there are no general courses on nanotechnology which would introduce the student to the unique properties and interactions of matter in the atomic scale, quite relevant for biological applications as well. Furthermore, unlike many other courses which include a practical part with laboratory exercises, neither of the two nanobiotechnological courses contain an experimental part. Rather than nanobiotechnology, the evaluation committee felt that the curriculum would be more suitable for a programme called "Molecular and Cellular Biotechnology", "Medical Biotechnology" etc. Discussions with administration and staff about this discrepancy did not bring any clarification to the discrepancy or a logical justification for the chosen name.

Biotechnology graduates should have a strong theoretical knowledge and ability to apply analytical, quantitative thinking and practical skills to solve biotechnological problems. The most important component of Master´s level studies to develop the problem-solving skills is the Master´s Thesis. The volume of Master´s thesis is 48 ECTS and it consists of three preparative phases (6 ECTS each) which provide an introduction to the topic, relevant literature, research plan etc., and a more experimental final part (30 ECTS). The topic is chosen and the preparative work begins already at the first semester, whereas the bulk of work (30 ECTS) is performed during the last (4th) semester. Although choosing the topic at an early stage gives sufficient time for good preparation, it may also be a problem because at the beginning of their studies, the students haven´t yet had time too see different laboratories and may be uncertain about their preferred areas of specialization. However, the students may be given a possibility to change their originally assigned topic, although it is not clear how this works in practise. Based on their topics (Appendix 8.4.) and the summaries of the theses which were on display during the site visit, the Master´s Theses are generally of adequate quality and deal with biotechnologically relevant questions.

Notwithstanding the misleading name, the programme provides sound biotechnology education, appropriate in the study fields of medical or molecular and cellular biotechnology.

### *3. Staff*

The faculty at Vilnius Gediminas Technical University (VGTU) involved in the Technology Study Field (Technology J700) Second Cycle Study Nanobiotechnology Programme have developed a strong and engaging programme for MS students that has strong support from the students and social partners. A review of the technical reports for the site visit provides evidence that the programme meets the legal teaching requirements. Furthermore, an inspection of MS thesis' provided additional support of the overall quality of the staff supervisory abilities to guide and develop a rewarding and fulfilling graduate learning/research experience. Nonetheless, this data and others elements highlighted in this report indicate that the collective staff experience has a much greater emphasis/skill set in moleculr biology and medical biotechnology rather than nanotechnology.

The programme is delivered by a staff of 9 teachers involving VGTU faculty and faculty from surrounding institutes in Vilnius. The faculty has selected a set of classes covering essential elements in biotechnology and to a lesser extent nanotechnology, including:

- Biology of prokaryotes and eukaryotes
- Stem cell biology, Systems biology, Tissue engineering
- Cellular technology, Immunotechnology, Diagnostic nanobiotechnology
- Gene engineering, Bioregeneration technologies, Nanomedicine, Industrial biotechnology

Based on the participating faculty CV's and discussions during the site visit the faculty in general is well skilled/experienced to deliver the proposed classes. It was unfortunate that the representative (responsible teacher) of the only nanotechnology-oriented course („Nanomedicine") was not present during the visit of the expert team. Formal class teaching is provided by VGTU staff although this experience is leveraged with experts from Vilnius University, Institute of Oncology and State Research Institute Centre for Innovative Medicine. The leveraging of non VGTU staff into this study programme overall has been accomplished professionally and this was evident from student responses and the review committee interactions with teaching staff. The programme has administrative quality control policies as carried out by the Commission for Competitions and Attestation set up by the VGTU Senate together with faculties' commissions for competitions and attestations, and the Human Resource Office.

Several of the teaching staff have experience outside their current position which provides a deeper and more enriching experience that the teaching staff can drawn upon for making their teaching relevant to the students. A review of the condensed CV's for the teaching staff indicate that most faculty reported 4 or more publications over the last 5 years focusing mostly on chemistry, biochemistry and molecular biology with little or no nanotechnological emphasis. In the future, improvements in publication impact and quantity should be continued to be pursued and improved.

A review of the teaching CVs of the teaching staff and discussion with faculty during the site visit made it clear that there were sufficient qualified teaching staff involved in the programme. This opinion was strengthened with site discussions with the participating study programme students and social partners.

The development of exchange agreements with foreign and Lithuanian entities on conducting scientific teaching/research or experimental developments is a promising trend for faculty and staff and should be encouraged to grow in the future. For example, programme teached were reported to have visited Lund University (Sweden) and Centre for Microscopy and Molecular Imaging, Universite' Libre de Buxelles (Belgium) under academic exchange programmes. The students expressed a strong degree of support for the faculty involved in this programme and furthermore select faculty have received national recognition. For example, Prof. Habil .dr. J. Kulys has been awarded the Lithuanian Science Award in the area of biomedical sciences in 2003.

Faculty participation in professional organizations, editorial journal boards, peer reviewing, and conference development committees has been noted and needs to be increased in the future. Faculty should strive to take senior positions on international editorial boards and in organizing international conferences and workshops. In future programme evaluations these efforts need to be specifically documented.

The faculty that contribute to this study programme are involved in research programmes in the Department of Chemistry and Bioengineering which is encouraged so that the teachers can explore practical aspects of work in their field of research and update the knowledge needed for staying current with the study programme. Several of the staff has reported prior experience prior to the VGTU position and this experience is viewed as a positive attribute that would strengthen their teaching experience. As reported in the study programme reports, the average age of teachers involved in the programme is 64.0 for professors and 51.1 for associate professors. Although this expertise is of benefit for the current students, for the long term longevity of the programme the programme administrators need to introduce new staff into the programme before senior faculty retire. In addition, some professors need improved English skills which should be readily addressed with select educational training. Finally, since only 44% of the teaching staff come from VGTU Department of Chemistry and Bioengineering and rest work in other institutions (Vilnius University, The Centre of Nature Investigations, Centre of Innovative Medicine) the loss of any faculty from the host institution would be very detrimental to this programme, which again emphasizes the need for a supportive staffing management plans for the future.

***4. Facilities and learning resources***

Facilities of the VGTU Faculty of Fundamental Sciences in Saulėtekis building are used for implementation of the Nanobiotechnology study programme. Lectures for Master students start at 4:20 in the afternoon. Therefore, students have possibility during the day to perform Master's thesis or to train practically in companies engaged in activities relevant to the learning outcomes of the study programme. Major part of lectures and exercises are delivered in 4 classrooms suitable for 20-30 students. Main laboratory work in biotechnology field takes place in specialized classroom of 15-17 workplaces and another one at Institute of Biochemistry. Expert team did not see laboratories specifically dedicated to nanotechnology studies and research. This point can be considered as inadequacy of the infrastructure for the tasks of the study programme.

All premises intended for studies are in compliance with the requirements of safety at work and personal hygiene. There are all conditions for students with disability to successful studies.

The list of 74 items of laboratory equipment is presented in SER. Exploitation of laboratory equipment has been started since 2011-2013. In laboratories is available basic equipment as well as new instruments as system for cultivation and analysis of cell culture, protein electrophoresis, transfer and gel documentation systems, real time PCR. Still not much evidences are given in respect to use of facilities aimed to study nanomaterials and elaborate MSc thesis related to nanomaterials. The joint laboratory of two Universities in Vilnius was established for studies of cell biology and cell technologies at Institute of Biochemistry which can accept about 10 postdocs and students every year and where students can perform their final thesis.

All classrooms for Nanobiotechnology studies are equipped with computers and video projectors. Wireless internet access is available which allows convenient use of personal computers during the lectures. Teaching materials for Nanobiotechnology studies are available at central library of VGTU and reading room of the faculty. According to SER, textbooks are of insufficient amount. Some lecture notes are prepared for individual courses. During the last 2 years, Faculty's library acquired nearly 200 books for students teaching. Majority of that books were issued during the last 5-10 years. VGTU has access to main databases, which can also be connected at home using VPC service. Students can read full text scientific and scholarly journals in all subjects and languages. The library and reading room space is sufficient for the students, with quite long working hours for the library (from 9.00 to 21.00) and 24 hours access to the reading room. Also students can use the newly built Science and Communication center in Saulėtekis, which is open 24/7.

Still as a problem in respect to material resources can be mentioned availability of facilities to provide higher level training during study process and elaboration of MSc thesis works. As an indicator to missing capacity to support research can be mentioned the fact that majority of MSc thesis are elaborated in cooperation partners – research institutes.

***5. Study process and student assessment***

Admission to postgraduate studies is organised by the admission commission of the University. No admission examinations are for the *Bioengineering* master study programme. The admission requirements are based on the principles commonly applied at the University. It is mentioned in the SER that applicants to the *Bioengineering* master study programme must be graduates of university-level studies and have Bachelor Degree in the corresponding area, however it is not specified which exactly area. It is a possibility to pass examinations if the missing knowledge of general study courses is less than 10 credits. During the on site visit it was mentioned that studies are chosen by students partially because of the sound name, which actually does not match well with the study pattern and learning outcomes.

There are minor fluctuations in the average competitive score which is around 9,82 (SER Table 8). Total candidates and candidates by first priority had a maximum in the year 2012. Total admission was from 5 to 7 students in the period being assessed. Usually the students who indicate the *Nanobiotechnology* study programme as the first priority get admitted.

The students at the University have to study general mandatory and some free elective subjects (courses). They have a scientific practice also. The self-dependent work of every student makes about 53,7-76,9 % of each subject course module.

Optional subjects in the *Nanobiotechnology* study programme comprise 12 credits. However, during the on site visit students mentioned the lack of possibility to actually choose optional subjects. Students have opportunities to agree upon the topic of the final thesis with the Department, employer and final thesis supervisor, taking into account students' preferences and market demand.

The criteria of assessing academic achievements are linked to the learning outcomes. A criterion-referenced and norm-referenced assessment system is used under which the level of student knowledge is measured according to the criteria set in the module of studies. A formula for the calculation of postgraduate students academic achievements is indicated in the course module cards. Studies of each course unit end by assessment.

The composition of assessment grades is explained by each teacher during the initial lecture. In the SER it is mentioned that 62,3 % of postgraduate students know their knowledge assessment criteria in advance, however here and further it is not clear how many of students population had actually took part in polling. Students cumulative assessment for the tasks set forth in the course module during the semester, grade of interim assessment on theoretical aspects and exam grade received during the examination session is included in the grade composition.

Academic progress of students is revealed from the analysis of postgraduate students examination results of the study courses. The examination results (SER Table 10) show that weighted average of grades is 8.

A drop-out analysis for the period of the programme implementation shows that full-time students usually terminated studies on their own will. During the first years, 7,7 % of students discontinued studies. The reasons for the voluntary discontinuation of studies are of personal nature.

According to the findings of the poll, the majority of MSc students (89.5 %) are positive about the time-table of training session and 100% of them believe the time-tables are published on time. A week of self-studies is scheduled in each semester of studies. Student's self-study is intended for students' preparation to contact work and performance of other tasks. 80 % of study hours are allocated for self-studies of MSc students under this programme. This time is enough to acquire additional knowledge and to develop generic and special competences.

Measures are taken to guarantee an ethically sound and proper academic conduct in the study tasks. In cases of cheating during examinations corresponding actions are undertaken, the highest penalty is removal from the University. Essays and final theses of the students are presented in electronic versions and checked for plagiarism. A *bona fide* statement confirming the autentity of the works must be signed by a student.

All postgraduate students are encouraged to engage into research activities. Students are regularly informed on the possibilities to write scientific articles, reports, participate in conferences. According to the poll results, the majority of postgraduate students (73.7%) reported to have good conditions to participate in scientific conferences and research workshops. The Faculty of Fundamental Sciences holds the Lithuania conference of young scientists *Science – Future of Lithuania. Bioengineering and Bioinformatics.* Several MSc students participated in

it. During the period of implementation of the *Nanobiotechnology* study programme, two MSc students participated in projects published by Lithuanian Academy of Sciences, as promoters.

The chairperson, members of the committee for the *Nanobiotechnology* study programme and final thesis supervisors provide regular consultations to postgraduate students. The students may also consult teachers engaged in the programme implementation and teachers delivering individual courses under the study programme at issue. All teachers have duty hours for additional consultations, which is very convenient to the students.

It is mentioned in the SER that cooperation between the University and companies/management authorities is organised by Integration and Career Office functioning at VGTU as well as staff members of the Department of Chemistry and Bioengineering and FMF Dean's Office provide consultations to students on career opportunities, however students indicated the lack of real support to get involved to labour market. There are only several graduates from the programme, thus the statistics on employment is not completely clear yet. The process of future placement of graduates is determined both by subjective factors (possibility to emigrate) and objective factors, such as complicated EU and Lithuanian legislative frameworks for biotechnology, nanomedicine. A certain part of students consider emigration as a good possibility to adapt to labour market.

During the programme implementation period, two of five MSc students (i.e., students admitted to the study programme in 2011) and three of seven MSc students (i.e., students admitted to the study programme in 2012), have been employed by the companies whose activities are directly related to their professional area, i.e., biotechnology and nanomedicine. To this effect, mention UAB *Sicor* and UAB *Biotechpharma* (researcher from 2011). Three MSc students of this group retained their jobs they had before enrolling for the studies.

***6. Programme management***

The programme of the "Nanobiotechnology" management is based on identifiable responsibilities and tasks. However, experts found that direct involvement of nanoscience experts in the programme management on a regular basis is missing. The age profile of the senior academic staff is biased towards older ages and younger faculty is largely missing (average age of professors is 59 years). In this respect development of staff renewal programme could be recommended. An important element of the programme management is preparation of self-assessment report. However, the aim of self-assessment is not only to sum up existing situation, but look forward, to evaluate trends in development of research and possible industrial developments, to identify, weaknesses and develop solutions for them. Communication between students and academic staff is good ("open door" policy) and size of group of students (5 students and 4 graduates) enable it and students as well as graduates appreciate it.

An important aspect of the study programme management includes involvement of local and international stakeholders in development of the study programme content. If there are identifiable stakeholders in the biotechnology, bioengineering fields then in respect to nanoscience and its applications expert team did not got evidences about involvement of stakeholders in the programme management process. This aspect is especially important considering the applied character of the study programme and evident need of direct involvement

of practitioners into the study processes (as lecturers, supervisors of BSc thesis). The number of graduates is too small to be able to discuss question about work with alumni and their involvement.

III. RECOMMENDATIONS

1. To ensure better compliance of the study programme content and curriculum with name of the programme. This could be achieved, for example, by increasing the content of nanotechnology and nanobiotechnology in the curriculum or by changing the programme name to better correspond to its current content.
2. To take actions to reduce drop-out rate of students, providing necessary advice, consultation
3. To ensure programme running in a long perspective, staff renewal need should considered and development of staff renewal programme could be recommended
4. To continue efforts to rise international research productivity of the staff
5. At the development of the study programme content, to pay more attention to the questions of ethical aspects in biotechnology
6. To increase supply of elective courses
7. To increase international mobility of students

## IV. SUMMARY

The aim and the proposed learning outcomes of VGTU's study programme „NanoBiotechnology" accordingly to study plan is highly innovative and the concept by itself have good prospects in future. The review committee clearly found a very strong and dynamic programme as it applies to the medical biotechnology, but the strength in the nanosciences was not as equally apparent. Indeed, only one study course of the study programme rigorously incorporates concepts of nanotechnologies into the learning experience and thus major concerns are in respect how rigorous the fundamentals of nanotechnology were developed in this programme. The programme provides sound biotechnology education, appropriate in the study fields of medical or molecular and cellular biotechnology, but the programme name is misleading. Either the VGTU staff and administration provide a substantial increase in learning experiences about nanotechnology or rename the programme to be more reflective of the current programme curriculum and its projected learning outcomes.

Another learning aspect that was not sufficiently developed and that needs further attention is the ethical responsibilities in biotechnology. Given the broad impact that biotechnology and medical sciences may have in society it is important that students are trained in the acceptable ethical norms by which one conducts research and development in biotechnology. This issues needs to be addressed in the near future. Considering the diverse background of incoming students, there is a need to improve recruiting efforts and provide additional tutorial support for incoming students. Further evident is a need in increasing international mobility of students; organisation of meetings with employers, placing information on their activities on the website of the Department**,** to ensure possibilities to choose more optional subjects, to ensure students actually know the content of the studies. The staff qualification is high and most of teaching staff are actively involved in the research, however as problem might be considered age balance of the staff and in this respect development of staff renewal programme could be suggested.

V. GENERAL ASSESSMENT

The study programme *Nanobiotechnology* (state code 621J70003) at Vilnius Gediminas Technical University is given **positive** evaluation.

*Study programme assessment in points by evaluation areas*.

| No. | Evaluation Area | Evaluation Area in Points* |
|---|---|---|
| 1. | Programme aims and learning outcomes | 2 |
| 2. | Curriculum design | 3 |
| 3. | Staff | 3 |
| 4. | Material resources | 3 |
| 5. | Study process and assessment (student admission, study process, student support, achievement assessment) | 3 |
| 6. | Programme management (programme administration, internal quality assurance) | 3 |
| | **Total:** | **17** |

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;
2 (satisfactory) - meets the established minimum requirements, needs improvement;
3 (good) - the field develops systematically, has distinctive features;
4 (very good) - the field is exceptionally good.

Grupės vadovas:
Team leader: Prof. Maris Klavins

Grupės nariai:
Team members: Prof. Kari Keinänen

Prof. Arthur J. Ragauskas

Dr. Egidijus Vladas Baškys

Raimonda Celiešiūtė

**Vertimas iš anglų kalbos**

<...>

Studijų kokybės vertinimo centras

## V. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus Gedimino technikos universiteto studijų programa *Nanobiotechnologija* (valstybinis kodas – 621J70003) vertinama **teigiamai**.

| Eil. Nr. | Vertinimo sritis | Srities įvertinimas, balais* |
|---|---|---|
| 1. | Programos tikslai ir numatomi studijų rezultatai | 2 |
| 2. | Programos sandara | 3 |
| 3. | Personalas | 3 |
| 4. | Materialieji ištekliai | 3 |
| 5. | Studijų eiga ir jos vertinimas | 3 |
| 6. | Programos vadyba | 3 |
| | **Iš viso:** | **17** |

* 1 - Nepatenkinamai (yra esminių trūkumų, kuriuos būtina pašalinti)
2 - Patenkinamai (tenkina minimalius reikalavimus, reikia tobulinti)
3 - Gerai (sistemiškai plėtojama sritis, turi savitų bruožų)
4 - Labai gerai (sritis yra išskirtinė)

<...>

## IV. SANTRAUKA

VGTU įgyvendinamos *Nanobiotechnologijos* studijų programos tikslas ir numatomi studijų rezultatai (remiantis studijų planu) yra labai novatoriški, o pati koncepcija yra perspektyvi. Ekspertų grupė aiškiai pastebėjo, kad programa tiek, kiek ji susijusi su medicinos biotechnologija, yra labai gera ir dinamiška, bet stiprioji pusė nanomokslų srityje nebuvo tokia akivaizdi. Faktiškai tik į vieną studijų programos kursą griežtai įtrauktos nanotechnologijų sąvokos, todėl kyla klausimas, kaip griežtai nanotechnologijų pagrindai išplėtoti šioje programoje. Ji suteikia rimtą biotechnologinį išsilavinimą, atitinkantį medicinos arba molekulinės ar ląstelių biotechnologijos studijų kryptį, bet programos pavadinimas yra klaidinantis. VGTU darbuotojai ir administracija turi iš esmės padidinti nanotechnologijų mokymų patirtį arba pakeisti programos pavadinimą, kad jis geriau atspindėtų dabartinį programos studijų turinį ir jos numatomus studijų rezultatus.

Dar vienas studijų aspektas, kuris nebuvo pakankamai ištobulintas ir kuriam reikia skirti daugiau dėmesio, yra etinė atsakomybė biotechnologijoje. Atsižvelgiant į galimai platų biotechnologijos ir medicinos mokslų poveikį visuomenei, svarbu išmokyti studentus priimtinų etikos normų, kurių laikydamiesi jie vykdytų mokslinius tyrimus ir taikomąją veiklą biotechnologijos srityje. Šiuos klausimus būtina spręsti netolimoje ateityje. Atsižvelgiant į tai, kad atvykstančių studentų išsilavinimas yra įvairus, būtina didinti pastangas pritraukti studentus ir atvykstantiems studentams suteikti papildomą konsultacinę pagalbą. Be to, reikia didinti tarptautinį studentų judumą, organizuoti susitikimus su darbdaviais, skelbti Katedros tinklalapyje informaciją apie jų veiklą, užtikrinti galimybę pasirinkti daugiau neprivalomų studijų dalykų, užtikrinti, kad studentai tikrai būtų susipažinę su studijų turiniu. Darbuotojų kvalifikacija yra aukšta; didžioji akademinio personalo dalis aktyviai dalyvauja moksliniuose tyrimuose, tačiau darbuotojų amžiaus santykį būtų galima laikyti problema ir šiuo atžvilgiu būtų galima pasiūlyti kurti personalo atnaujinimo planą.

Studijų kokybės vertinimo centras

## III. REKOMENDACIJOS

1. Užtikrinti, kad studijų turinys ir programos sandara geriau atitiktų programos pavadinimą (nanomokslai) – tai yra padindinti dėstomų nanotechnologijos ir nanobiotechnologijos dalykų skaičių arba pakeisti programos pavadinimą, kad jis geriau atitiktų jos dabartinį turinį.
2. Taikyti priemones, padėsiančias sumažinti studentų nubyrėjimo lygį – teikti reikalingą informaciją, konsultacijas.
3. Siekiant užtikrinti programos ilgaamžiškumą, reikėtų apsvarstyti personalo atnaujinimo būtinybę; rekomenduotina parengti darbuotojų atnaujinimo programą.
4. Stengtis toliau didinti darbuotojų produktyvumą tarptautinių mokslinių tyrimų srityje.
5. Tobulinant studijų programos turinį daugiau dėmesio skirti biotechnologijos etiniam aspektui.
6. Didinti pasirenkamųjų dalykų skaičių.
7. Didinti tarptautinį studentų judumą.

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