NATIONAL UNIVERSITY OF LIFE AND ENVIROMENTAL SCIENCES OF UKRAINE

Department of ecobiotechnology and biodiversity

" APPROVED"
The dean of faculty of plant protection, biotechnology and ecology
_____Kolomiets Yu.V.

CONSIDERED AND APPROVED
At the meeting of the Department of ecobiotechnology and biodiversity
protocol № 12 of "1" June 2021
Head of department
_____Patyka M.V.

"CONSIDERED"
Guarantor of ED "Biotechnology and bioengineering " ED " Bachelor "
_____ Klyachenko O.L.

EDUCATIONAL AND METHODICAL COMPLEX OF THE DISCIPLINE

BIOSAFETY (USE OF BIOTECHNOLOGY)

Speciality: 162 «Biotechnology and bioengineering»
educational program "Biotechnology and Bioengineering"
Faculty of plant protection, biotechnology and ecology
Developed by Doctor of Agriculture Science, Prof. Lisovyy M.M.

Київ – 2021 р.

1. Description of the discipline

"Biosafety (use of biotechnologies)"

Discipline, direction, speciality, educationally qualifying level	
Speciality	162 «Biotechnology and bioengineering»
Educationally qualifying level	«Bachelor»
Characteristics of discipline	
Type	Normative
General amount of hours:	51
Number of ECTS credits	2
Amount of the substantial modules	2
Term paper	_____ (name)
Form of control	Exam
Descriptions educational discipline for full-time students	
	Form of studies daily
Year of preparation	4
Semester	5
Lectures	15 hours
Practice works	30 hours
Laboratory training	
Independent work	
Individual work	
A week's hours: Lectures	 3 hours 39 hours

2. The main goals and tasks of discipline

The main goals of discipline are: theoretical and practical training of students for providing safe environment.

The main task of discipline is forming of specialists which are able:

- to provide an analysis of quality and background of different species of plants, animals and microorganisms used for biotechnological production;
- to provide selection of methods staff safety during technological processes.

In result of discipline studying the student should **know**:

- Modern conception about heredity and variability, their origin and molecular substance;
- Understanding consequence of effect of scientific-technical progress on the planet gene pool, distinguishing positive and negative aspects of interaction of living organisms with the environment changing in result of climatologic, technical and informational reorganization;
- Main methodological approaches for the control of genetic status of organisms;
- Modern analytical methods for the control of food and feed quality;
- Ethical aspects and problems of biosafety;
- Main rules and agreements in the field of biosafety which are accepted in Ukraine and in other countries;
- Principles and mechanisms for manipulation with genome, achievements of genetic engineering and therapy as well as modern biotechnologies, their advantage and risk for planet biosystem.

Student should be **able**:

- To use scientific, educational and methodical literature which concerned biosafety;
- To analyze possible consequences of active and wide involving of genetically modified organisms and number of modern biotechnologies on the state of environment;
- To be aligned in the use of the separate achievements of scientific-technical progress which are most non-destructive for living organisms and how much these achievements may be used without effect on the genetic pool of living organisms;
- To estimate advantages and risk for people, animal and plants; the application of genetic engineering and modern technologies.

3.The program of educational discipline

Substantial module 1.

Theme 1. Biosafety, its main points and tasks. General characteristics of separate directions of scientific-technical progress and possible variants of its effect on the genome of living organisms

Unit of heredity – gene. Gene localization. Molecular structure of genes. Genome. Genome of pro- and eukaryotes. Natural mobile genetic elements, retrotransposones. Problems of application of hereditary and non-hereditary transgenic characters. Changing of hereditary during natural and industrial hybridization. Changing hereditary by methods of genetic engineering. Problems of protection of hereditary of organisms.

Theme 2. Heredity and variability – basic abilities of living organisms. Molecular basis of heredity and variety.

Unit of heredity – gene. Gene localization. Molecular structure of genes. Genome. Genome of pro- and eukaryotes. Natural mobile genetic elements, retrotransposones. Problems of application of hereditary and non-hereditary transgenic characters. Changing of hereditary during natural and industrial hybridization. Changing hereditary by methods of genetic engineering. Problems of protection of hereditary of organisms.

Theme 3. Horizontal and vertical genes transfer.

Traditional intraspecific and interspecific hybridization (transference of gene blocks with different dimensions) plants, animals, microorganisms as basis of evolutionary process.

Theme 4. Practical achievements of modern biotechnology and genetic engineering.

Obtaining of new pharmacological preparations (insulin, vaccine to poliomyelitis). Expression of human somatotropine (grown hormone) in the tobacco chloroplasts. Genetically modified plants (transgenic rice sorts, potatoes, maize, tomatoes and others). Tasks, achievements and problems of genetic engineering. Compensation of inherent genetic defects of maturity and treatment of diseases aroused during ontogenesis.

Substantial module 2.

Theme 1. Modern methods of molecular genetics. Characteristics of mutations.

Ferments of restriction. Vectors for the molecular cloning. Plasmids, bacteriophage, cosmide, shuttle vectors, artificial chromosomes of yeast. Creation of genomic libraries. Construction of restrictive maps. Southern blot analysis.

Mutations connected with the destruction of genetic code.

Theme 2. Biotechnologies of manipulation with genes. Genetically modified organisms: their main points, directions of use.

Strategy of genetic engineering works. Preparation of DNA of the needed gene from genome. Transfer genes in the cells of other organisms: microinjection, electroporation, transfection, packing in liposomes, bombardment by micro-particles.

Overcoming problems which are connected with the intensive involving: a) the genetically modified organisms to solve problems of deficit of products in countries of

third world; b) environment recultivation from different types of toxic substances; c) synthesis and obtaining of pharmacological preparations; d) improving quality of the existing plant sorts and animal species; e) using plants as factories for directed chemical synthesis of any substances and so on.

Theme 3. Problems of possible ecological consequences from use of genetically modified organisms.

Possibility of GMO effect on environment. Advantages and risk. Principles of caution and sufficient equivalence. Marking genetically modified foods, feeds, seed and medical preparations.

Theme 4. Main rules and agreements in the field of biosafety.

Cartagena protocol and Orchuskaja convencion. Codex of Alimentariusa. Bilbao and Inujama Declarations. General declaration of JUNESKO about genome and rights of human.

4.Structure of educational discipline

Theme title	Amount of hours					
	Altogether	including				
		L	P	Lab.	Ind.	i.w.
1	2	3	4	5	6	7
SUBSTANTIAL MODULE 1.						
Theme 1. Biosafety, its main points and tasks. General characteristics of separate directions of scientific-technical progress and possible variants of its effect on the genome of living organisms	6	3	3			
Theme 2. Heredity and variability – basic abilities of living organisms. Molecular basis of heredity and variety.	6	3	3			
Theme 3. Horizontal and vertical genes transfer.	6	3	3			
Theme 4. Practical achievements of modern biotechnology and genetic engineering.	3	2	1			
Together	21	11	10			
SUBSTANTIAL MODULE 2.						
Theme 1. Modern methods of molecular genetics. Characteristics of mutations.	6	3	3			
Theme 2. Biotechnologies of manipulation with genes. Genetically modified organisms: their main points, directions of use.	6	3	3			
Theme 3. Problems of possible ecological consequences from use of genetically modified organisms.	6	3	3			
Theme 4. Main rules and agreements in the field of biosafety.	6	3	3			
Together	24	12	12			
Amount of hours						
Term paper						
Amount of hours	45	23	22			

5. Topics of seminars

№	Theme title	Amount of hours
1	No provided for educational plan	

6. Themes of practical treinings

№	Theme title	Amount of hours
1	Structure of DNA and RNA, replication, transcription, and translation. Construction of genome and chromosome libraries	4
2	Classical immune analysis and its use for the determination of quality and origin foods and feeds	3
3	Monoclonal antibodies and their use in immune analysis	4
4	Modern immune chemical analysis: varieties and its use at the providing of biosafety	4
5	Documents in the field of biosafety which regulate the use of genetically modified organisms in different aspects	4
6	Familiarization with the fulfillment of ELISA-method	4
7	Fulfillment of instrumental analysis for the revealing of individual substances in samples of water and some foods at the registration of biospecific interactions by the optical biosensor based on the surface plasmon resonance	4
8	DNA electrophoresis	3

7. Themes of laboratory training

№	Theme title	Amount of hours
1	No provided for educational plan	

8. Teaching methods

The success of learning as a whole depends on the intrinsic activity of students, the nature of their activities, it is the nature of the activity, degree of autonomy and creativity should be important criteria in choosing a method.

Explanatory, illustrative technique. Students acquire knowledge by listening to the story, lecture on educational or instructional materials through the on-screen guide in the "ready" form. Perceiving and interpreting facts, evaluations, conclusions, they remain within the reproductive (reproductive) thinking. This method is used widely as possible to transmit large amount of data. It can be used for presentation and assimilation of facts, approaches, assessments and conclusions.

Reproductive method. This refers to the application of learned from sample or regulations. An activity of trainees is algorithmic, ie corresponding instructions, orders, rules - similar to the present sample situations.

The method of problem presentation. Using any source and means teacher before teaching material, poses the problem, formulating cognitive tasks, and then exposing the system is proved by comparing the views, different approaches shows way to solve the problem. Students are like witnesses and accomplices in scientific research.

Partly-search or heuristic method. Its essence - to organize the active Solver nominated teacher (or self-contained) or cognitive tasks under the supervision of the teacher or based on heuristic programs and guidelines. The process of thinking becomes productive nature, but it gradually directs and supervises the teacher or the students on the basis of the above programs (including computer) and manuals. This method is one of the varieties of which are heuristic conversation - a proven way to enhance thinking and motivation to learning.

The research method. After reviewing the material, production problems and tasks and short oral or written instruction by those who teach self-study literature sources are monitoring and measurements and perform other search action. Initiative, independence, creativity manifested in research activities fully. Methods of training is directly transferred to the methods which mimic and sometimes implement scientific research.

So, consider the six approaches to the classification of teaching methods, six

9. Criteria of appreciation of students knowledge's on intermediate and final phases of studying

Student knowledge's are appreciated according to system of modular-rate control. Whole programmed material of the "Biosafety" course devided on two blocks – module: Module A – "Biotechnologies for manipulation with genes": Module B – "Lows and ecological-genetic aspects of biosafety".

Calculated rates of discipline are equal 100 points. Educational rates – 70 points. Taking into account volume and structure of programmed material of discipline it was divided it for two appropriate modules. Calculated rate mark of each module was taken on the level 35 points. Minimal rate mark for each module is 17,5 points.

For each module it is planed test which includes 30 questions. Each question contents 4 answers one of which is right.

Test is in writing and individual for each student.

Rial rate of student with educational work will be estimated according to obtained points at the module fulfillment. To be present at the test the student should have no less as 50% of planed rate from the educational work. According to "Rules about module-rate system of education of students and appreciation of their knowledge's" it will be written "credit" in the student's record-book. Rate mark will be included according to system of ECTS (A, B, C, D, E, FX, F) in special list.

The results of studying of discipline by students content a weighted average rate.

Student rate of discipline equal to sum of educational work rate and rate of test.

10. The methods and scale of students knowledge estimation

The methods of estimation : examinations while the semester; *(progect; report;)* total written test.

Balls distribution:

Examinations while the semester								Individual scientific project	Total control	Sum
The substantial module 1				**The substantial module 1I**						
Common balls quantity				*Common balls quantity*						
T. 1	T. 2	T. 3	T. 4	T. 1	T. 2	T. 3	T. 4			
5 bolls	5	5	5	5	5	10	5	*25*	*30*	*100*

11. Methodological support

Scientific methods of teaching include: state educational standards, curricula and training programs in all standard and optional subjects, training programs, production and other practices, books and manuals, instructional and teaching materials for seminars, practical and laboratory classes , individual teaching and research tasks, test papers, text and electronic versions of the tests for the current and final testing, training materials for independent work of students.

12. The recommended literature

Main

1. Ghimulev I.F. General and molecular genetics: School-book. – Novosibirsk, 2003. – 479p.
2. Tozkij V.M. Genetics. – Odessa: Astroprint, 2002. – 710p.
3. Sendgher M., Berg P. Genes and genomes. Mir: M., 1999, 2-volumes, 391p.
4. Sorochinskij B.V., Danil'chenko O.O., Kripka G.V. Biotechnical (genetically modified) plants. – Kiev: Publ. „KVIZ", 2007. – 219p.
5. Frimmel Ch., Brok J. Fundamentals of immunology. M., Mir, 1986, 253p.
6. Immune enzymatic analysis. Eds. Ngo T.T. and Lengoff G. M., Mir, 1988.

7. Lesson of science and technique, Biotechnology: Non-isotopic methods of immune analysis, v 3, 1987.
8. Monoclonal antibodies./ Eds. R.G. Kennet.- M.: Medicine, 1983, 416p.

Additional

1. Nikolajchuk V.I., Gorbatenko I.Ju. Genetic engineering. – Uzhgorod, 1999. – 189p.
2. Genetics and Selection in Ukraine at the turn of millenniums: in 4-th volums /Eds.: V.V. Morgun e.a. – Logos: K, 2001.
3. Starodub N. F., Starodub V.M. Immune sensors: original, achievements and perspectives. Ukrainian Biochemical J., 2000, **72**, N 4-5, P. 147-163.
4. Starodub N.F., Starodub V.M. // Biosensors and control of pesticides in water and foodes. Chemistry and Technology of Water, 2001. v.23. N 6. P.612-638.