| INDBIOT-E07: | **TECHNOLOGY OF PROBIOTIC STARTER CULTURE** |
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| **GENERAL INFORMATION** | |
| Course Coordinator(s) | Mirela Lučan Čolić, PhD, assist. prof. |
| Associate(s) | - |
| Study Programme | Interdisciplinary Graduate Study Programme in English: Biotechnology |
| Course Status | Elective |
| Year of Study, Semester | 2nd Year / 4th Semester |
| Credits (ECTS) | **4** |
| Teaching Method (number of classes) | Lectures 20; Seminars 10; Exercises 15 |
| Expected Number of Students in the Course | 25-30 |
| **COURSE DESCRIPTION** | |
| **Course Aims** | |
| The aim of the course is to introduce students to the concept of probiotics, the selection criteria for a probiotic strain, the procedure for evaluation of probiotic potential of microbial strain, the conditions in production and preservation of probiotic starter cultures, with an emphasis on modern processes in probiotic technology. Also, gaining knowledge of probiotic applications in various industries. | |
| **Prerequisites for Enrolment and the Entry Competencies Required for the Course** | |
| - | |
| **Learning Outcomes at the Programme Level Contributed by the Course** | |
| INDBIOT-2; INDBIOT-4 | |
| **Learning Outcomes at the Course Level** | |
| After successful completion of this course students are expected to be able to:<br>1. Explain the concept of probiotics<br>2. Relate the mechanism of action to the functional properties of probiotics<br>3. List the criteria for the selection of probiotics and chart the procedure for evaluating the potential probiotic<br>4. Describe the process of production of probiotic starter cultures<br>5. Explain the benefits of applying new trends in the production of probiotics<br>6. Differentiate and compare the use of probiotics in different industries<br>7. Identify possible problems in the production, storage and administration of probiotics and identify possible solutions | |
| **Course Content** | |
| **Lectures.** The concept of probiotics: definition and development of probiotics. Taxonomy of probiotic starter cultures. Functional properties of probiotic microorganisms; clinically approved health benefits. The mechanism of action of probiotic. Sources of potential probiotic strains. Isolation, identification and characterization of potential novel probiotics. Selection criteria for probiotic strains (general, technological, functional). Procedure for evaluation of probiotic. Genetically modified probiotics. The industrial aspect of probiotic production. The probiotic bacterial biomass growth, isolation and concentration. Freezing, lyophilization, lyoprotectors. Alternative drying processes for probiotics and starter cultures. Microencapsulation. Stability of probiotics during storage. Application of probiotic starter cultures. Functional food. Prebiotics. Milk probiotic products. Non-dairy probiotic products. Food bio-preservative. Bacteriocins. Biotherapeutics. Legislation; marking.<br>**Seminars.** Possible solutions for current and future challenges in the production, storage and administration of probiotics.<br>**Laboratory exercises.** Isolation, identification and characterization of potential new probiotics. | |

Production of probiotic foods. Stability of probiotics during storage.

**Teaching Methods**

Lectures; seminars; laboratory exercises

**Students' Obligations**

Attendance at all forms of classes is mandatory and the students are obligated to attend all knowledge tests. The students may be absent from 30% (full-time students) and 50% (part-time students) of each of the forms of classes, provided that the absence is justified. An exercise or a seminar which has not been completed must be made up through a midterm exam.

**Monitoring the Activity of the Students (*Connecting Learning Outcomes, Teaching Methods, and Grading*)**

| Class-related activity | ECTS | Learning outcome | Student activity | Evaluation method | Grade points | |
|---|---|---|---|---|---|---|
| | | | | | Min. | Max. |
| Attending classes | 0.2 | 1-6 | Attendance at classes | Keeping records | 2 | 10 |
| Seminars | 1.0 | 1-6 | Seminar work | Presentation of seminar work | 10 | 20 |
| Laboratory exercises | 0.8 | 7 | Practical work | Laboratory exercises report | 8 | 20 |
| Final exam | 2.0 | 1-7 | Studying for the final exam | Written exam | 30 | 50 |
| **Total** | **4** | | | | **50** | **100** |

Evaluation of the written part of the final exam

| Percentage of correct answers (%) | Grade points |
|---|---|
| >95.00 | 50 |
| 90.00-94.99 | 47 |
| 85.00-89.99 | 45 |
| 80.00-84.99 | 40 |
| 75.00-79.99 | 38 |
| 70.00-74.99 | 35 |
| 65.00-69.99 | 33 |
| 60.00-64.99 | 30 |

*Forming the final grade:*
The grade points awarded during class attendance are added to the points granted for the final exam. The grading process is conducted by absolute distribution, i.e. based on total achievements, and compared to the numerical system in the following manner:
A – Excellent (5): 90-100 grade points; B – Very Good (4): 80-89.99 grade points; C – Good (3): 65-79.99 grade points; D – sufficient (2): 50-64.99 grade points

**Mandatory Literature (available in the library and via other media)**

| Title | Number of copies in the library | Availability via other media |
|---|---|---|
| Foerst P, Santivarangkna C: Advances in Probiotic Technology, CRC Press, New York, 2016. | - | - |
| Silva JPS, Freitas AC: Probiotic Bacteria: Fundamentals, | - | - |

| | | |
|---|---|---|
| Therapy, and Technological Aspects, CRC Press, New York, 2014. | | |

**Additional Literature**

1. Liong M-T: Probiotics: Biology, Genetics and Health Aspects, Springer, New York, 2019.
2. Charalampopoulos D, Rastall RA: Prebiotics and Probiotics Science and Technology, Springer, New York, 2009.
3. Lee YK, Salminen S: Handbook of probiotics and prebiotics, Wiley Blackwell, New York, 2009.
4. Tamime AY, Thomas LV: Probiotic Dairy Products, Wiley Blackwell, New York, 2018.
5. Scientific and professional papers related to specified chapters (available online)

**Quality Assurance Procedures Designed to Ensure the Acquisition of Outcomes and Competencies**

Anonymous, quantitative, standardised student survey on the course and the teacher's work implemented by the Quality improvement office of the Faculty of Food Technology Osijek and/or the Faculty of Medicine Osijek.

**Note**

E-learning is not included in the class quota, but it is used in teaching and it contains links to various sites and video and audio materials available on websites.