AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: In vitro testing of biomaterials

Academic year: 2019/2020 Code: ZSDA-3-0112-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: prof. dr hab. inż. Pamuła Elżbieta (epamula@agh.edu.pl)

Module summary

PhD student learns about the principles of cell cultures and acquires practical skills of in vitro evaluation of biomaterials, medicines and medical devices.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	PhD student can work in a team, present and discuss the results obtained during laboratory class in a clear and comprehensive way	SDA3A_K01	Activity during classes
Skills: he can			
M_U001	PhD student can propose methods to evaluate cytotoxicity and cytocompatibility of biomaterials	SDA3A_U01	Activity during classes
M_U002	PhD student can perform basic cell culture in vitro tests and present obtain results	SDA3A_U03	Activity during classes
Knowledge: he knows and understands			
M_W001	PhD student knows the principles of particular biochemical and molecular biology methods used for in vitro evaluation of biomaterials and medical devices	SDA3A_W01	Activity during classes

Number of hours for each form of classes

	Form of classes										
Suma	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
20	8	0	12	0	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	PhD student can work in a team, present and discuss the results obtained during laboratory class in a clear and comprehensive way	-	-	+	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	PhD student can propose methods to evaluate cytotoxicity and cytocompatibility of biomaterials	-	-	+	-	-	-	-	-	-	-	-
M_U002	PhD student can perform basic cell culture in vitro tests and present obtain results	-	-	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	PhD student knows the principles of particular biochemical and molecular biology methods used for in vitro evaluation of biomaterials and medical devices	+	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	20 h
Preparation for classes	10 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Summary student workload	50 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

1. Cell culture principles: laboratory equipment, sterile working conditions
2. Introduction to microscopic methods in cell culture tests in vitro
3. Introduction to biochemical methods and molecular biology tests
4. Application of cell cultures in the study of biomaterials, medicines and medical devices

Laboratory classes

1. Introduction to work in cell culture laboratory, sterile conditions, passage, microscopic observations, cell counting
2. In vitro biomaterials testing using cell cultures (e.g. osteoblasts, fibroblasts, epithelial cells, endothelial cells)
3. Assessment of cytotoxicity and cytocompatibility using microscopic techniques (optical and fluorescence microscopy; histological and immunohistochemical staining) and biochemical tests (metabolic activity: MTT, XTT, AlamarBlue)
4. Gene expression studies at RNA level (real-time PCR) and protein level (e.g. ELISA, Western Blot)

Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.
Laboratory classes: W trakcie zajęć laboratoryjnych studenci samodzielnie rozwiązują zadany problem praktyczny, dobierając odpowiednie narzędzia. Prowadzący stymuluje grupę do refleksji nad problemem, tak by otrzymane wyniki miały wysoką wartość merytoryczną.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Positive grade from performance at the laboratory classes and multimedia presentation of the results obtained during laboratory classes

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:
– Attendance is mandatory: Yes
– Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z syllabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.
Laboratory classes:
– Attendance is mandatory: Yes
– Participation rules in classes: Studenci wykonują ćwiczenia laboratoryjne zgodnie z materiałami udostępnionymi przez prowadzącego. Student jest zobowiązany do przygotowania się w przedmiocie wykonywanego ćwiczenia, co może zostać zweryfikowane kolokwium w formie ustnej lub pisemnej. Zaliczenie zajęć odbywa się na podstawie zaprezentowania rozwiązania postawionego problemu. Zaliczenie modułu jest możliwe po zaliczeniu wszystkich zajęć laboratoryjnych.

Method of calculating the final grade
80% – grade for multimedia presentation of the results obtained during laboratory classes
20% – grade for performance at laboratory classes
Further details will be provided during the first meeting in the beginning of the semester.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:
In case of a justified absence on laboratory classes the PhD student should immediately contact the teacher who will individually determine the options to catch up on laboratory classes.

Prerequisites and additional requirements
Basic knowledge in chemistry, physics, materials science and biology

Recommended literature and teaching resources
1. Cell Culture Manual 2011-2014; Sigma-Aldrich, https://www.sigmaaldrich.com/content/dam/sigma-aldrich/docs/Sigma-Aldrich/Brochure/1/cell-culture-manual.pdf
4. Recent publications provided by the teacher

Scientific publications of module course instructors related to the topic of the module
1. Wojak-Ćwik, I.M., Rumian, Ł., Krok-Borkowicz, M., [et al.], Scharnweber, D., Pamuła, E. Synergistic effect of bimodal pore distribution and artificial extracellular matrices in polymeric scaffolds on osteogenic differentiation of human mesenchymal stem cells Materials Science and Engineering C 97, 2019, 12-22.
2. Małgorzata Krok-Borkowicz, Elena Filova, Jaroslav Chlupac, Jan Klepetar, Lucie Bacakova, Elżbieta Pamuła, Influence of pore size and hydroxyapatite deposition in poly(l-lactide-co-glycolide) scaffolds on osteoblast-like cells cultured in static and dynamic conditions, Materials Letters 241, 2019, 1-5.
3. Ł. Rumian, H. Tiainen, U. Cibor, M. Krok-Borkowicz, M. Brzychczy-Włoch, H. J. Haugen, E. Pamula, Ceramic scaffolds with immobilized vancomycin-loaded poly(lactide-co-glycolide) microparticles for bone defects treatment, Materials Letters 190, 2017, 67-70.
4. T. E. L. Douglas, G. Krawczyk, E. Pamula, [et al.], Generation of composites for bone tissue enginnering applications consisting of gellan gum hydrogels mineralized with calcium and magnesium phosphate phases by enzymatic means, Journal of Tissue Engineering and Regenerative Medicine 10(11), 2016, 938–954.

Additional information
None