<table>
<tr><td>Name of the course</td><td colspan="3">Pain and genes – custom made pain treatment</td><td>Code</td><td></td></tr>
<tr><td>Type of study program<br>Cycle</td><td colspan="3">Integrated studies – Medicine</td><td>Year of study</td><td>1</td></tr>
<tr><td>Credits (ECTS) :</td><td>2</td><td>Semester</td><td>2</td><td>Number of hours per semester (l+e+s)</td><td>15+10</td></tr>
<tr><td>Status of the course:</td><td>elective</td><td>Preconditions:</td><td></td><td>Comparative conditions:</td><td></td></tr>
<tr><td>Access to course:</td><td colspan="3">1st year students</td><td>Hours of instructions:</td><td></td></tr>
<tr><td colspan="2">Course teacher:</td><td colspan="4">Associate professor Sandra Kostić, PhD</td></tr>
<tr><td colspan="2">Consultations:</td><td colspan="4"></td></tr>
<tr><td colspan="2">E-mail address and phone number:</td><td colspan="4">sandra.kostic@mefst.hr</td></tr>
<tr><td colspan="2">Associate teachers</td><td colspan="4"></td></tr>
<tr><td colspan="2">Consultations:</td><td colspan="4"></td></tr>
<tr><td colspan="2">E-mail address and phone number:</td><td colspan="4"></td></tr>
<tr><td>The aims of the course:</td><td colspan="5">The aim of the course is to enable students to understand and adopt the basic concepts related to pain and personalized pain treatment based on the knowledge from areas of pharmacogenomics.</td></tr>
<tr><td>Learning outcomes (general and specific competences):</td><td colspan="5">Upon completion of the anatomy course, the successful student should acquire the following knowledge, skills and attitudes:<br>A) Knowledge (REMEMBER, UNDERSTAND, APPLY, ANALYSE AND EVALUATE) measurable outcomes: (1) Describe and explain the basic pain terminology and definitions (e.g. nociception, nociceptors, central and peripheral sensitization, allodynia, hyperalgesia…), (2) describe the main difference between acute and chronic pain, (3) apply fundamental knowledge and describe the methods, drugs and different approaches for the pain treatment available to patients today in specific clinical situations, (4) recognize and name the most relevant achievements in the field of pharmacogenomics and their therapeutic potential, (5) describe, analyze and explain the examples from the scientific literature which point to the link between the gene-environment interaction and our pain tolerance, (6) name and describe specific pain disorders which result from gene mutations, including congenital insensitivity to pain.<br>B) Skills (PERCEPTION, READY, GUIDANCE) measurable outcomes: (1) critically evaluate the choice of pain treatments in the context of the pain genetics as well as pain subjectivity, (2) communicate the latest achievements in the field of pain</td></tr>
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| | research by reading and evaluating the latest literature and presenting your results in front of the students.<br>C) Attitudes (ACCEPTANCE, REACTION, ACQUISITION OF VALUES) measurable outcomes: (1) take into account the positive and negative aspects of introducing the new technologies for human treatments, 2) accept the existence of subjectivity of pain and the need to relieve the patients of their pain (3) Describe and explain your perspectives on ethical aspects of pain treatment through specific examples of ethical issues and medical and scientific misconduct. |
| ***Course content (Syllabus):*** | Lectures:<br>-The basic pain terminology and definitions (e.g. nociception, nociceptors, central and peripheral sensitization, allodynia, hyperalgesia…)<br>- The main difference between acute and chronic pain; Methods, drugs and different approaches for the pain treatment available to patients today<br>- Pharmacogenomics – the future of custom made pain treatment<br>- The most relevant achievements in the field of pharmacogenomics and their therapeutic potential – from preclinical trials to clinics<br>- The link between the gene-environment interaction and our pain tolerance: epigenetics<br>Seminars:<br>- Specific pain disorders which result from gene mutations, including congenital insensitivity to pain |

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| ***Format of instruction (mark in bold)*** | **Lectures** | Exercises | **Seminars** | **Independent assignments** |
| | **Consultations** | Work with mentor | Field work | Other |
| | | | | |
| ***Student responsibilities*** | Final exam; searching the literature, active participation in lectures, seminars. Written exam. | | | |
| ***Screening student work (mark in bold)*** | **Class attendance** | **Class participations** | Seminar essay | Practical training |
| | Oral exam | **Written exam** | Continous assesment | Essay |
| | | | | |

**Detailed evaluation** within a *European system of points*
*(Example)*

| STUDENTS RESPONSIBILITIES | HOURS | PROPORTIONS OF ECTS CREDITS | PROPORTIONS OF MARK |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Class attendance and participations | | 0,5 | |
| Seminar essay | | | |
| Written exam | | 1,5 | 100% |
| Oral exam | | | |

Further clarification:
Assessment of students' performance will be based on their general activity during the course. It will include active participation in the debates, and preparation of the given units (articles) for the ppt on seminars.

According to the regulations of the study, final grade is obtained:
A = 91-100% 5
B = 79 to 90% 4
C = 67 to 78% 3
D = 55 to 66% 2
F = 0 to 54% 1

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| ***Required literature:*** | - Webster LR, Belfer I. Pharmacogenetics and Personalized Medicine in Pain Management. Clin Lab Med. 2016 Sep;36(3):493-506. doi: 10.1016/j.cll.2016.05.007. Epub 2016 Jun 22.<br>- Ko TM, Wong CS, Wu JY, Chen YT. Pharmacogenomics for personalized pain medicine. Acta Anaesthesiol Taiwan. Mar;54(1):24-30, 2016.<br>- Devor M: How Do Pain Genes Affect Pain Experience? In: Pain Genetics: Basic to Translational Science, First Edition. Editors: Belfer I and Diatchenko L. John Wiley & Sons, Inc., 1-14, 2014.<br>- Meyer K, Kaspar BK. Making Sense of Pain: Are Pluripotent Stem Cell–derived Sensory Neurons a New Tool for Studying Pain Mechanisms? Mol Ther. 2014 Aug;22(8):1403-5.<br>- Mogil JS. Pain genetics: past, present and future. Trends Genet. 2012 Jun;28(6):258-66.<br>- Dib-Hajj SD, Waxman SG. Translational pain research: Lessons from genetics and genomics. Sci Transl Med. 2014 Aug 13;6(249):249sr4.<br>- Cregg R, Russo G, Gubbay A, Branford R, Sato H. Pharmacogenetics of analgesic drugs. Br J Pain. 2013 Nov; 7(4):189-208.<br>- Janicki PK. Pharmacogenomics of Pain Management. In: Comprehensive Treatment of Chronic Pain by Medical, Interventional, and Integrative Approaches, 23 T.R. Deer et al. (eds.), American Academy of Pain Medicine 2013.<br>- Young EE, Lariviere WR, Belfer I. Genetic basis of pain variability: recent advances. J Med Genet. 2012 Jan;49(1):1-9. |
| ***Optional literature:*** | |
| ***Additional*** | |

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| ***information about the course*** | |

Annexes: calendar classes

| *The number of teaching units* | TOPICS AND LITERATURE |
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| ***I.*** | Title: Basic pain terminology; |
| | Short description: Definition of terminology in the pain field, and the types of pain; |
| | Literature: required and optional |
| ***II.*** | Title: Neurobiology and genetics of pain; |
| | Short description: The principle of neurobiology, pain pathway, and description of the genes involved in pain processes |
| | Literature: required and optional |
| ***III.*** | Title: Pharmacogenomics - the future of pain management; |
| | Short description: The role of pharmacogenomics for different pain treatments |
| | Literature: required and optional |
| ***IV.*** | Title: Congenital insensitivity to pain |
| | Short description: The genetics, phenotype and life quality of the people with CIP |
| | Literature: required and optional |
| ***V.*** | Title: Pain genetics – from preclinical trials to clinic; Epigenetics – gene and environment interaction; Pain research |
| | Short description: Examples of forming a tolerance threshold for pain by interaction between the genes and the environment; examples of the findings from pain research studies and their translation to the clinics |
| | Literature: required and optional |