**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOL** | HEALTH SCIENCES | | | | |
| **ACADEMIC UNIT** | DEPARTMENT OF BIOLOGICAL APPLICATIONS AND TECHNOLOGY | | | | |
| **LEVEL OF STUDIES** | undergraduate | | | | |
| **COURSE CODE** | **BEE723** | **SEMESTER** | | **8th** | |
| **COURSE TITLE** | Evolution and Development-Perspectives for scientific research and health | | | | |
| **INDEPENDENT TEACHING ACTIVITIES** *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits* | | | **WEEKLY TEACHING HOURS** | | **CREDITS** |
| Lectures | | | 3 | | 3 |
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| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | | |  | |  |
| **COURSE TYPE**  *general background,  special background, specialised general knowledge, skills development* | general background, skills development | | | | |
| **PREREQUISITE COURSES:** | n/a | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No | | | | |
| **COURSE WEBSITE (URL)** | <http://ecourse.uoi.gr/> link | | | | |

1. **LEARNING OUTCOMES**

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| **Learning outcomes** | |
| *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.*  *Consult Appendix A*   * *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area* * *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B* * *Guidelines for writing Learning Outcomes* | |
| Evolutionary development (evo-devo) is a new field in science which emerges from the fact that the study of embryo development provides the central evidence for the principle of a common descent. Modern tools in research, such as gene expression profiling, have surprised biologists in many ways. Specifically, it is now known that the same genes that control an insect’s development, in fact control human development. Evo-devo investigates the evolution of developmental processes to understand phenotypic changes. These include processes such as embryogenesis and regeneration. New directions in evo-devo have interested scientists in other fields. Medics, Ecologists and even Sociologists have started to look at disease, conservation and behavior with an evolutionary point of view. This course aims to introduce new scientists into evo-devo and broaden the opportunities in their future career development.  Upon successful completion of the course students will:  (1) have acquired a familiarity with the study of biological sciences in English. They will also acquire skills in understanding, writing and presenting biological concepts in English.  (2) have acquired basic knowledge of how important developmental processes have shaped the evolution of animal organisms.  (3) have understood how different branches of biology such as developmental biology, evolution, stem cell and cancer biology are interconnected.  (4) have acquired the ability to design cross-disciplinary experiments in order to answer research questions as well as to understand the results of scientific research on issues related to developmental biology, evolution and health. | |
| **General Competences** | |
| *Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?* | |
| *Search for, analysis and synthesis of data and information, with the use of the necessary technology*  *Adapting to new situations*  *Decision-making*  *Working independently*  *Team work*  *Working in an international environment*  *Working in an interdisciplinary environment*  *Production of new research ideas* | *Project planning and management*  *Respect for difference and multiculturalism*  *Respect for the natural environment*  *Showing social, professional and ethical responsibility and sensitivity to gender issues*  *Criticism and self-criticism*  *Production of free, creative and inductive thinking*  *……*  *Others…*  *…….* |
| * Team work * Working independently * Working in an international environment * Project planning and management * Production of new research ideas * Production of free, creative and inductive thinking * Criticism and self-criticism | |

1. **SYLLABUS**

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| Introduction: The ability of developmental processes to evolve. Evo-Devo meets Darwin. Understanding the developmental aspects of Evolution.  Germ cells – Cleavage. How can the large size of the gamete be explained? Why are there differences between the gamete size of different animal taxa? Why does the cleavage stage of embryonic development occur?  Body Plans: Origin and Preservation of the Body Plan. The appearance of bilateral symmetry. Phylotypic stage: when frog and prince are the same. Why are all vertebrate embryos similar in the phylotypic stage? What decisions are taken to diverge vertebrate development after this point?  Germ layers: From 1 to 2, to 3. The path to developmental complexity. When, how and why the germ layers deviate. Characteristic markers of germ layers and applications in stem cell biology.  Hox genes: The evolution of Hox genes from flies to humans. Developmental anomalies and Hox genes.  Conserved signaling pathways: Evolution of the Wnt, Notch, Hedgehog, FGF, TGFβ pathways. Functions ranging from embryogenesis to tumorigenesis.  Chordata: The appearance and necessity of the notochord and the neural crest. From the notochord of invertebrates to the vertebrate skeleton. Amphioxus explains why he does not have a neural crest. Neural crest dysfunction: Developmental abnormalities and cancer.  The evolution of epigenetic regulation: epigenetic modifications from prokaryotes to man and their biological consequences. The evolution of imprinted genes (gender antagonism and other evolutionary hypotheses). Why was the production of parthenogenetic and cloned mammals difficult?  Tissue Regeneration: Why do some animals regenerate, while others do not? Mechanisms of regeneration. Wound Healing Mechanisms. Regeneration of amphibian limbs. Could human tissues ever be regenerated?  Aging: Aging as a feature of multicellular sexually reproducing organisms. Why don’t Anemones get old? C. elegans and experimental extension of the lifespan of an organism.  Methodology and Experimentation: Animal Models (C. elegans, Drosophila, Choanoflagellates, Crustaceans, Anelids, Zebrafish, Xenopus, Chicken, Mouse) and why they are selected in Evolutionary-Developmental Research. Techniques (genomics / transcriptomics / epigenomics, CRISPR-Cas9, transgenic animal models for gene expression in time and space). |

1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY** *Face-to-face, Distance learning, etc.* | *Face-to-face* |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Use of PowerPoint software  Course information available on the electronic platform e-course  Announcements on the course website  Communication through e-mail correspondence |
| **TEACHING METHODS**  *The manner and methods of teaching are described in detail.*  *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*  *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 39 | |  |  | |  |  | | Study hours | 36 | | Course total | 75 | |  |  | |
| **STUDENT PERFORMANCE EVALUATION**  *Description of the evaluation procedure*  *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*  *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Written exam. |

1. **ATTACHED BIBLIOGRAPHY**

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| Selected bibliography: articles and review papers accessible on the web. Endless Forms Most Beautiful: The New Science of Evo Devo, Sean B. Carroll, Reprint EditionEvolving Pathways: Key Themes in Evolutionary Developmental Biology, Giuseppe Fusco and Alessandro Minelli, 1st Edition |