جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Epigenetics and Chromatin - B 321

Division	Biological and Environmental Sciences & Engineering Division
Course Number	B 321
Course Title	Epigenetics and Chromatin
Academic Semester	Summer
Academic Year	2017/2018
Semester Start Date	06/10/2018
Semester End Date	08/09/2018
Class Schedule (Days & Time)	09:00 AM - 05:00 PM | Sun Mon Tue Wed Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Valerio Orlando	Valerio.Orlando@KAUST.EDU.SA	+966128082674		Thursday, 9-10 am
Wolfgang Fischle	wolfgang.fischle@kaust.edu.sa	+966128082498	3334, 2, Ibn Al-Haytham (bldg. 2)	Thursday, 9-10 am

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description

This course combines theoretical knowledge with state-of-the-art practical approaches. It was developed on the basis of advanced method courses for students held at the European Molecular Biology Organisation (EMBO) and International Max Planck Research Schools (IMPRS). Profs. Orlando and Fischle (including their laboratories' staff) will introduce up to date research questions and experimental technologies in current Epigenetics and Chromatin Research. Hands-on experiments with step-by-step instructions will be carried out in the KEEP laboratories involving laboratory staff.

Topics include:

- Chromatin Architecture: fractionation of cells and nuclei for chromatin preparation, basic analysis of chromatin architecture (nucleosome positioning, and remodeling)
- Histone Code: biochemistry of modifying enzymes, binding proteins and RNAs in chromatin regulation (protein-protein, protein-nucleic acids interactions, complex purification)
- Epigenome Structure I: genome-wide mapping of histone modifications, chromatin factors, ncRNA (ChIP, ChIP-seq, ncRNA mapping, data analysis)
- Epigenome Structure II: nuclear architecture, long-range chromatin interactions, chromosomal domains (chromosome paint, 3C/4C/5C/Hi-C)
- Cell Memory and Imprinting: DNA methylation and cellular imprinting (analysis of DNA methylation by different methods)

The course is open to KAUST M.Sc. and Ph.D. students (min. 6 and max. 12 participants in total). All students will have to complete reading assignments on basic and advanced topics in Epigenetics and the experimental approaches used in this field (to be provided by instructors ahead of the beginning of the course). Written reports summarizing and discussing the experiments in reflection of this theoretical background are part of the evaluation for all students.

Course Description from Program Guide	The major aim of the three-week summer block course is to train participants (min. 6, max. 12) in experimental Cell Biology on the example of Chromatin Biochemistry, Epigenome Structure and Nuclear Organization. To improve students skills in designing, executing and analyzing experiments, the course combines two principles: theory and practice. Besides covering the fundamental background and theory of Epigenetics and Genome Regulation, participants will learn basal and cutting-edge experimental technologies that are currently used to answer key questions at the frontiers of Epigenetics research. The course is shaped according to international EMBL (European Molecular Biology Laboratories) and MPI (Max Planck Institutes) advanced method courses for M.Sc. and Ph.D. students. Profs. Orlando and Fischle (including their laboratories staff) will introduce Applied Epigenetics on the basis of dissection of classical and recent experiments. Student participants will carry out several hands-on experiments with step-by- step instructions.
Goals and Objectives	The course combines two major training objectives: - to provide the participants with fundamental theoretical understanding of basic and complex Epigenetic Phenomena - to give the participants hands-on training in the planning, execution and analysis of simple and advanced experiments in Cell Biology in general and with a focus on Chromatin Biology, Epigenome Structure and Nuclear Organization
Required Knowledge	- basic understanding of molecular and cell biology methods - basic experimental skills in molecular and cell biology M.Sc. students should have succesfully completed the following courses: Molecular and Cellular Biology Lab (B241); Cell Biology I (B241) and II (B223). The instructurs will judge these requirements on a case by case basis.
Reference Texts	- Epigenetics, CSHL press, 2nd edition - Epigenetics Protocols (Methods in Molecular Biology) 2nd edition - detailed handouts provided by instructors
Method of evaluation	**33.00**% - Written report **33.00**% - Presentation **33.00**% - Attendance and Participation
Nature of the assignments	- students will need to prepare the theoretical background of different scientific topics on the basis of individual and group reading assignments (primary and secondary literature) - under supervision students will execute different experiments individually and in groups - on the basis of detailed assignments students will prepare and present seminars in front of the class to provide the background and scope of different experimental methods and in context of different scientific questions - participants are required to prepare a scientific report covering the experiments executed in the form of a manuscript (introduction, rationale, results, discussion, literature)
Course Policies	Attendance of theoretical and practical classes is mandatory.
Additional Information	Daily schedule: each day of the course is divided in theoretical and practical parts <u>theory:</u> 8:30 – 10:00 lecture/seminar on the specified topics of Chromatin Biology and Epigenetics (classroom: lecturers, Ph.D. students) <u>practice:</u> 10:00 – 11:00 theoretical introduction to specified experiment(s) of the day (classroom: instructors) 11:00 – 16:30 execution of specified experiments in small groups under supervision (KEEP laboratories: instructors); variable lunch break (1 hr) 16:30 – 17:30 discussion of results (classroom: instructors)

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 07/08/2018 Mon 07/09/2018 Tue 07/10/2018 Wed 07/11/2018 Thu 07/12/2018	08/07/2018 theory: basic chromatin architecture I practice: chromatin reconstitution I 09/07/2018 theory: basic chromatin architecture II practice: chromatin reconstitution II 11/07/2018 theory: chromatin components I practice: chromatin fractionation I 12/07/2018 theory: chromatin components II practice: analysis of basic chromatin properties
2	Sun 07/15/2018 Mon 07/16/2018 Tue 07/17/2018 Wed 07/18/2018 Thu 07/19/2018	15/07/2018 theory: the histone code I practice: analysis of readers of chromatin modifications 16/07/2018 theory: the histone code II practice: chromatin immunoprecipitation (ChIP) I 17/07/2018 theory: next generation sequencing practice: chromatin immunoprecipitation (ChIP) II 18/07/2018 theory: bioinformatics I practice: ChIP-Seq I
3	Sun 07/22/2018 Mon 07/23/2018 Tue 07/24/2018 Wed 07/25/2018 Thu 07/26/2018	22/07/2018 theory: bioinformatics II practice: ChIP-Seq II 23/07/2018 theory: DNA methylation practice: analysis of DNA methylation I 24/07/2018 theory: imprinting practice: analysis of DNA methylation II 25/07/2018 theory: nuclear architecture I practice: Chromosome Conformation Capture I 26/07/2018 theory: nuclear architecture II practice: Chromosome Conformation Capture II
4		N/A
5		N/A
6		N/A
7		N/A
8		N/A
9		N/A
10		N/A
11		N/A
12		N/A
13		N/A
14		N/A
15		N/A
16		
17		
18		

Note

The instructor reserves the right to make changes to this syllabus as necessary.