MANIFESTO OF STUDIES 2013

1st YEAR - MANDATORY COURSES -				
Course	**Teacher**	**Hours**	**Synopsis**	**Evaluation procedure**
Laboratory Safety Course **(Mandatory)**	Prof. Mancini I. Dr. Provenzani A.	12	General Laboratory Procedures, Equipment Use, and Safety Considerations. The course consists of lectures and hands-on activities and provides training in chemical manipulation, laboratory activity, biology hazard, fire, and radiation safety.	Biology part: written exam.
Laboratory of Applied Biology	Various	36		Written report by the teacher
1st year students must attend at least 60 hours during the first year by filling the remaining hours with one facultative course (see below).				

2nd YEAR - MANDATORY COURSES -				
Course	**Teacher**	**Hours**	**Synopsis**	**Evaluation procedure**
Scientific Publishing & Communication	Dr. Dahm R.	24	The proposed course aims to convey the basic skills needed to publish and communicate scientific results. It combines lectures, which will explain the basic principles of good writing practice and presentation skills, with practical parts during which the students will apply their newly acquired knowledge. The target audiences of the course are PhD students, but the course will also be open to select Master's students and junior postdoctoral scientists.	
Preclinical research and clinical development programs of drugs	Prof. Borlak J.	12	The main objective of this course is to provide an overview of biomedical research strategies and clinical development programs in the drug/ biotech industry. The students will be made familiar with some basic experimental concepts as well as legal requirements for the development of novel drugs. Emphasis is given to the knowledge gain from genome biology and complex data analysis arising from high throughput technologies. *1.* Introduction into basic concepts in preclinical drug research and development *2.* Methods in experimental drug research and clinical development with emphasis on	Group exam of n=4 students; students are requested to prepare a 20 min presentation followed by in-class discussion; upon request students can be examined individually.

			microarray , mass spec, high throughput cell biology assays and in vivo imaging modalities *3*. Genetic models of disease with emphasis on cancer biology and validation of such disease models for the development of novel anticancer drugs *4.* The molecular basis for drug metabolism and disposition including case studies *5.* The molecular basis for drug induced toxicities including case studies *6.* Basic concepts in pharmacogenetics and pharmacogenomics and its application to individualised drug therapies *7.* The application of genomic sciences for improved and individualized drug therapies *8*. Round table discussion with students – and 2 to 3 short presentations from students on selected topics of the course objective.	

2st year students must attend at least 60 hours during the first year by fill the remaining hours with facultative courses (see below).

FACULTATIVE COURSES

Course	Teacher	Hours	Synopsis	Evaluation procedure
Scientific English	CIAL	24		
Statistics	Prof. Pugliese A.	12	Populations and samples; data types; description of data: histograms, measures of centre and spread. Basics of probability: probability models, random variables, probability distributions and their properties: binomial, Poisson and normal distribution. Indipendence. Parameter estimates; confidence intervals; one and two sided confidence intervals of the mean. Hypothesis testing; comparing one mean with a fixed one, or comparing two means; size of the sample and power of the test. Test of independence of two factors. Introduction to analysis of variance and regression models. Students will be invited to perform statistical computation through computer software (esp. Excel or R, depending on aims), but this will not be described in detail in the course.	Written exam.
Bioinformatics	Dr. Blanzieri E. Dr. Passerini A.	12	Design of microarray experiments. Normalization of microarray data. Loess. Significance of Analysis of microarray data, t-test, SAM, Cluster Algorithms. Kmeans. Hierachical Clustering. Distances used in clustering. Use of R for microarray data analysis. Probabilistic graphical models: probabilistic inference, structure and parameter learning. Hidden Markov Models for biological sequence analysis: Pair-HMMs, Profile HMMs.	Probabilistic graphical models: Bayesian network project.
Business Planning for biotech leaders	Dr. Milani S.	12	The course prepares PhD students to become potential leaders gaining an understanding of the fundamentals of organizational effectiveness-management finance, entrepreneurship and project management Course topics include: 1. Income statement Introduction for biotech projects 2. Balance Sheet Introduction for biotech projects	

			3. Free cash flow Introduction for biotech projects 4. How venture capitalists evaluate biotech projects 5. How to write a business plan for private/venture funding The course goes beyond the traditional debate over costs and grants as it will examine the critical processes required to develop and deliver biotech projects/products into biotech global market. The students will also work on a biotech project business plan by evaluating alternative financial/sustainability approaches.	
Cancer Genetics	Prof. Inga A.	12	Cancer has been defined as a genetic disease of progressively altered cellular circuitries. These lectures will aim at describing pivotal cancer genes in the context of the cellular pathways they directly influence and the consequences of their alteration for cancer cells. The first lecture will be an introductory overview of the hallmarks of cancer. The five following lectures will each tackle specific cellular functions relevant to oncogenesis: 1-proliferation / senescence /metabolism 2-apoptosis 3-inflammation/microenvironment 4-angiogenesis/metastasis 5-epigenetics. Emphasis will be given on recent advances in the field. Each two-hour block will be divided in a descriptive, review-style first part followed by discussion of results from very recent papers.	Oral exam consisting on the presentation and critical discussion of a paper (30 min total) Depending on the number of students a group presentation could be assigned (2 students with a paper, one being the presenter the second the discussant)
Chemical modifications and organic synthesis of biomolecules	Prof. Mancini I.	12	The course will focus on the core principles of synthetic strategy and methodology, with the discussion of recently published topics in the field and the possibility to verify some practical aspects in the laboratory. Strategies in total synthesis: linear and convergent sequence, conversion of functional groups, protective groups, carbon-carbon reactions, application of organometallic reagents; workup and isolation of the products. New methodologies: solvent role and choice, solid supported synthesis, microwave irradiation and other eco-friendly techniques. Asymmetric synthesis: stereoselectivity and introduction of new desired elements of chirality. Asymmetric and bio- catalysis using enzymes and chiral natural molecules. Examples of natural product synthesis. Design and synthesis in modern drug discovery: combinatorial and biomimetic approaches. Synthesis of supra-molecular systems, also with the involvement of proteins and DNA.	
Synthetic Biology	Dr. Mansy S.	12	The course will explore different aspects of the new field of synthetic biology. Topics ranging from top-down and bottom-up perspectives, BioBricks (parts, devices, and chassis), genetic circuits, bioengineering, minimal genomes, minimal cells, orthogonal systems, as well as combinatorial and directed evolution methods will be covered. Students will learn how synthetic biology is changing the biotechnology industry, e.g. in the pharmaceutical and biofuels industries, and how work on synthetic biology is helping to reveal how the chemical and physical complexities of a cell give rise to the emergent behavior of life.	Oral exam & participation

Molecular Spectroscopic Techniques	Prof. Guella G.	12	The lessons include principles and applications of molecular spectroscopy for the elucidation of bioorganic structures and binding phenomena. Main emphasis will be on modern applications of Nuclear Magnetic Resonance and Mass Spectrometry in biochemical contexts but fundamentals of electronic and vibrational spectroscopy will be also presented. *Molecular spectroscopy***.** *Mass Spectrometry* *Principles of Nuclear Magnetic Resonance (NMR).*	Individual reports and discussion on assigned topic & participation.
Introduction to systems biology	Dr. Csikasz-Nagy A.	6	Students will be introduced to the basic concepts of systems biology. On a historical perspective, some of the breakthrough experimental and computational results of systems biology will be presented. The basic concepts of molecular network dynamics (oscillations, hysteresis, bistability) and network analysis (scale-free, small world) will be discussed. The systems biology workflow will be presented on the example of cell cycle research.	Oral exam & participation
Networks in biology	Dr. Jordan F.	12	We discuss the network perspective and the basics of network analysis in biology. Classical and novel methods will be presented, describing the structure and dynamics of directed, weighted and signed graphs. It will be discussed how to characterize networks by local (e.g. node centrality) and global (e.g. link distribution) measures. We discuss biological relevance and applications from molecular biology to systems ecology. Consultancy and exam will follow the course.	Oral exam
Introduction to metabolomics	Dr. Mattivi F.	12	Topics: A comparison of metabolomics vs conventional analytical techniques. Sample handling and extraction: a difficult compromise NMR-based experiments MS-based experiments Metabolic profiling vs. metabolic fingerprinting or accuracy vs coverage Gaschromatography in metabolomics High performance liquid chromatography in metabolomics Quality control flowchart for metabolomics Study design and planning of the sequence Features extraction, data alignment, structural annotation Introduction to MS imaging Examples of biological applications of metabolomics: i) biofluids and fecal water; 2) plants and fruits	
DNA damage, cell cycle and cancer	Ferrari S.	6	DNA damage represents a serious threat to the stability of our genome. Failure to repair DNA damage before cell division is widely recognized as a major cause of cancer. The course will begin with an in-depth coverage of the cell division cycle and of the pathways controlling transition through the different phases. This will be followed by a description of the different types of structural damage occurring to DNA and by a	<10 students: Individual presentation of a topic of choice (10 min) + questions (5 min) >10 students: Written exam (multiple-choice test + selected questions)

			comprehensive coverage of the molecular mechanisms put in place to address repair of the damage. Next, the signaling aspect of the DNA damage response (DDR) will be examined, with particular emphasis on checkpoint pathways. Finally, we will examine how inappropriate functioning of checkpoints favours the development of cancer.	

The students enrolled at the International Doctoral School in Biomolecular Sciences are obliged to attend courses, seminars, symposia and practical courses organized by the Doctorate School.

Seminars. National and international researches are invited to present their research within the seminar cycle. Internal seminars (journal clubs and progress report) must regularly organized in order to present and discuss new published results or to shown data of ongoing research activities. The students must attend at least 15 seminars per year.

Symposia. A symposium (named *work in progress*) which all the doctorate students have to attend is organized once a year. All PhD students will give a short presentation of their results. For the doctorate student, this meeting is the occasion to socialize and in particular to know the projects and the results of his/her colleagues. Moreover, students have the opportunity to gain experience in communication and presentation of scientific results.

COURSE	SPEAKER	HOURS		YEAR
Journal Club	PhD candidate	3	The Journal club is an important scientific update and discussion and it is part of the teaching program of the PhD student. The Journal Clubs aim to guide the students to a critical reading of a scientific work, with particular attention to the methodological approaches, research and analysis, other than those normally used in their specific field of research and interpretation of data as well as to implement the knowledge of young researchers. Period: twice a year.	1-2-3
Progress Report	PhD candidate	3	Twice a year, the student must present a summary of the results achieved as well as the status of the project.	1-2-3

Doctoral students must obtain 14 learning credits during the first and second year, corresponding to:
- 60 educational hours (1 credit every 6 hours)
- 15 seminars (2 credits),
- 2 Journal clubs (1 credit),
- 2 progress reports (1 credit).