MANIFESTO OF STUDIES 2012

1st YEAR				
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 test.
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.
Scientific Publishing & Communication **(Mandatory)**	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.	

2nd YEAR				
Course	**Teacher**	**Hours**	**Synopsis**	**Evaluation procedure**
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.
Preclinical research and clinical development programs of drugs **(MANDATORY)**	Prof. Borlak J.	18	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 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.	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.
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	Oral exam consisting on the presentation and critical discussion of a paper (30 min total) Depending on the number of students a

			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.	group presentation could be assigned (2 students with a paper, one being the presenter the second the discussant)
Strategy and Finance in Biotech and Pharma **(MANDATORY)**	Dr. Milani S.	12	The course prepares PhD students to become potential leaders gaining an understanding of the fundamentals of organizational effectiveness-strategy, leadership, finance and operations. Course topics include: *1.* Leadership, Mission and Leading Strategic Vision *2.* Biotech and Pharmaceuticals Markets in a world of change *3.* Income statement Introduction *4.* Balance sheet Introduction *5.* Free Cash Flow Introduction *6.* Financial Research Management and Metrics for Success *7.* How Venture Capitalists evaluate start-up research projects *8.* Developing research project vs create value: how to write a business Plan *9.* Research Project Management and Operations Management. The course goes far beyond the traditional debate over costs, as it will examine the critical processes required to develop and deliver strategic positioning of research project into biotech global success. The students will also work on a research project business plan by evaluating alternative business models, competitive strategies and financial approaches.	
RNA Molecular Biology and Biotechnology	Dr. Denti M.	12	The course aims to familiarize the students with cutting-edge new discoveries in the field of RNA biology, and we expect the students to be familiar with the major topics of RNA-based regulation by the conclusion of the course. Topics will include an introduction to RNA structure, folding and dynamics, RNA/RNA and RNA-protein interactions, the role of RNA in catalysis of biological reactions and in pre-mRNA splicing. The course also covers the recently discovered micro RNAs, RNA regulatory switches, large noncoding regulatory RNAs, and the role of RNA in human diseases and novel, RNA-based therapeutics (RNA interference, antisense RNA, ribozymes).	Presentation of cutting-edge papers, suggested by the teacher and presented by a 30 min journal club by the student.
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	Presentation and discussion of a specific topic of interest

			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
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

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).