The teaching staff of the University of Trento, assisted also by visiting professors, will provide enhancement courses regarding specific topics of biological and biotechnological relevance. Furthermore during the first year, practical laboratory activities are planned, in order to offer to the new students the opportunity to know directly the scientific topics carried out by different research groups. Internationally renowned teachers will be invited to hold specific courses of particular scientific relevance.

COURSES 1st year	TEACHER	HOURS	SYNOPSIS	PERIOD
Laboratory Safety Course	Prof. Ines Mancini, Drs Alessandro Provenzani and Yuri Bozzi (UNITN)	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, fire, and radiation safety.	17,22,23, 28 February 2011
Statistics	Prof. Andrea Pugliese (University of Trento)	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.	21,25 February, 3,7,14,15 21 March 2011
Bioinformatics	Dr. Enrico Blanzieri and Dr. Andrea Passerini (University of Trento)	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.	30-31 March, 1st April 4-5-6 April 2011
Scientific Publishing & Communication	Dr. Ralf Dahm (CNIO, Spanish National Cancer Research Centre Madrid, Spain)	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.	September- November 2011

		60		
COURSES 2nd year	**TEACHER**	**HOURS**	**SYNOPSIS**	Period
Molecular Spectroscopic Techniques	Prof. Graziano Guella (University of Trento)	12	The lessons include principles and applications of molecular spectroscopy for the elucidation of bioorganic structures and binding phenomena. Modern applications of electronic and vibrational spectroscopy (IR and Raman), Nuclear Magnetic Resonance and Mass Spectrometry in biochemical contexts will be presented. *Molecular spectroscopy***.** The spectrum of the electromagnetic radiation and the interaction light-matter. Different spectroscopic applications. Excited states and the Boltzmann law. UV-VIS Spectroscopy . Electronic transitions and absorption coefficients. The chromophores in the organic compounds. The Lambert-Beer's Law. *Vibrational Spectroscopy.* The Hook's Law. Vibrations of chemical bonds and group frequencies. Stretching and bending frequencies of more important organic functional groups. Selection rules in IR spectroscopy. Guide for IR spectra's interpretation. *Principles of Nuclear Magnetic Resonance (NMR).* Magnetic moments and Zeeman effect. Natural abundance and relative sensitivity of selected nuclei (1H, 13C, 31P). Thermal equilibrium and population of energy levels. NMR of a population of identical nuclei Operational definition of chemical shift and of scalar spin-spin coupling constants. Experimental considerations on the collection of routine proton and carbon-13 NMR spectra. Guidelines for simple NMR spectra's interpretation. Introduction to Mass Spectrometry. Atomic mass and natural abundances of selected isotopes. Molecular mass: nominal and exact mass of an ion. Instrumental block diagram of a mass spectrometer. Ionization methods: EI, ESI and MALDI techniques. Sensitivity and resolution in mass spectroscopy. Applications of MS in metabolomics and proteomics.	25-27 January, 1-3 February 2011

Preclinical research and clinical development programs of drugs (mandatory course)	Prof. Jürgen Borlak (Medical School of Hannover)	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 (i.e. confocal laser microscopy, flow cytometry etc) 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 individualised drug therapies 8. Round table discussion with students – and 2 to 3 short presentations from students on selected topics of the course objective	18-22 April, 2-6 May 2011
Cancer Genetics	Dr. Alberto Inga (University of Trento)	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	28-29-30 31 March - 8-11 April 2011

			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.	
Management and Finance in Biotech and Pharmaceuticals (mandatory course)	Dr. Stefano Milani (President Blossom & Company)	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.	21, 25, 28 March, 1, 4, 8 April 2011
RNA Molecular Biology and Biotechnology	Dr. Michela Denti (University of Trento)	12	*RNA Molecular Biology and Biotechnology* 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, pre-mRNA splicing, and viral replication. 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-	8,10,15, 17, 22, 24 February 2011

			based therapeutics (RNA interference, antisense RNA, ribozymes). In addition, these new discoveries will have a significant impact on our understanding of human development and disease, and open up new avenues for development of therapeutics. The last topics of the course cover these medically-relevant aspects of RNA biology.	
Synthetic Biology	Dr. Sheref Mansy (University of Trento)	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.	**28 February, 1, 3, 7, 8, 10 March 2011**
Introduction to systems biology	Dr. Attila Csikasz-Nagy (The Microsoft Research - University of Trento Centre for Computational and Systems Biology)	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.	7, 8, 10 March 2011
Networks in biology	Dr. Ferenc Jordan (The Microsoft Research - University of Trento Centre for Computational and Systems Biology)	6	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.	21, 22, 23, 29 March 2011

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 will be invited to present their research within the seminar cycle. Internal seminars (journal clubs and progress report) will be 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 will be organized once a year. They will present posters regarding their project and will give a short presentation of their results. For the doctorate student, this meeting will be the occasion to socialize and in particular to know the projects and the results of his/her colleagues. Moreover, they will 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 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).