Courses borrowed from the PhD Course in Experimental and Translational Medicine

Introduction to Systems Biology

CFU: 1.5 Lecturer: Prof. Mauro Fasano

The course is a primer to work with large datasets (big data or wide data) that suffer from dimensionality and sparsity. After describing common strategies for feature selection and extraction, students will learn how to obtain functional information from extracted features. Moreover, foundations of graph theory and network science will be described and discussed.

Lesson 1 (4 h): Introduction to Systems biology. Emergent properties and nonlinear complex systems. Dimensionality reduction in datasets (NGS, proteomics). Univariate filters. Multivariate analysis (PCA, PLS, PLS-DA). Cross-validation. The receiver operating characteristic. Recursive feature elimination. Practical activities.
Lesson 2 (4 h): Over-representation analysis. The Fisher exact test. Correction for multiple testing (Bonferroni vs. Benjamini-Hochberg). Gene/protein databases. Ontology and pathway databases. Other databases for functional enrichment. Gene-set enrichment analysis. Practical activities.
Lesson 3 (4 h): Principles of graph theory. Network statistics. Topological analysis. Random networks vs. real networks. Clustering strategies. The Cytoscape environment. Practical activities.

The NGS technique: theory, applications and future perspectives

CFU: 2 Lecturers: Prof. Mauro Fasano, Giovanni Porta, Ian Marc Bonapace, Francesco, Acquati

This minicourse will be organized in four lessons on the following arguments: a) the NGS technique and the relative possible applications; b) third and fourth generation sequencing; c) functional aspects of gene expression and regulation; d) NGD Data analysis workflow and functional enrichment.

Applicazioni in ambito oncologico della tecnologia NGS a scopo diagnostico, prognostico e terapeutico: - il modello del carcinoma colorettale Il modello del carcinoma endometriale

CFU: 0.5 Lecturer: Prof. Daniela Furlan

Il minicorso ha lo scopo di delineare l'impiego sempre più diffuso della tecnologia NGS nella pratica clinica oncologica e di mostrare come le classificazioni tumorali richiedano l'integrazione di conoscenze approfondite dei meccanismi tumorigenici per il riconoscimento di entità biologiche distinte e per la corretta impostazione degli approcci terapeutici.

Cancer stem cells: understanding tumour hierarchy and heterogeneity for cancer treatment

CFU: 0.75 Lecturer: Prof. Ian Marc Bonapace, Carlo Catapano

Cancer stem cells (CSCs) are self-renewing cells that are identifiable in most liquid and solid cancers and contribute to tumor onset, expansion, resistance, recurrence and metastasis following therapeutical approaches. CSCs are identified by the expression of cell surface markers, which depends on the type of tumor. The transition between CSCs with cancer cells occurs in tumors and is under the control of reciprocal signals between CSCs and the tumor microenvironment (TME), including the CSC niche. Different degrees of evidence indicate that cancer stem cells are a relevant cause of failure of conventional chemo/radiotherapy, due to their resistance to such therapeutic approaches. Therefore, targeted therapy to eliminate CSCs is essential.
Lesson 1: From Stem cells to Cancer Stem Cells.
Lesson 2: Cancer Stem Cell's niche. The relation with the microenvironment
Lesson 3: Targeting Cancer Stem Cells. Innovative approaches for targeting CSCs.