UNIVERSITÀ DI PAVIA

Anno Accademico 2017/2018

RADIOBIOLOGY

Enrollment year	2017/2018
Academic year	2017/2018
Regulations	DM270
Academic discipline	MED/36 (DIAGNOSTIC IMAGING AND RADIOTHERAPY)
Department	DEPARTMENT OF PHYSICS
Course	
Curriculum	Fisica della materia
Year of study	1°
Period	2nd semester (01/03/2018 - 15/06/2018)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	OTTOLENGHI ANDREA DAVIDE (titolare) - 6 ECTS
Prerequisites	Basic knowledge on biology (DNA & Cellular structures), and on ionizing radiation-matter interactions.
Learning outcomes	The aim of the course is to give students an introduction on the fundamental principles of radiobiology and radiation biophysics (from physical interactions, to initial biological damage and its time evolution), and on how a complex biological systems may react to the perturbation induced by ionizing radiation. At the end of the course the students are expected to be able to use such basic principles for designing radiobiological research activities (integrating experimental and theoretical approaches) and to contribute to applied research for the estimation of risk and for the optimization of medical use of radiation.
Course contents	The course will introduce students to the mechanisms relative to the physical, chemical and biological effects of ionising radiation at sub-cellular, cellular, and organism level (including cancer and

	non-cancer risk, particularly at low doses). After a description of the physical stage of the interaction radiation - biological structures, the time evolution of the radiobiological damage will be analysed, also covering the chemical (e.g. radiation chemistry of water and DNA solutions) and biological effects (e.g. radiation damage to DNA in a cellular environment and repair processes). Damage evolution and repair and compensation of various radiobiological endpoints and in particular their role in the development of radiation-induced diseases and disorders, will be considered. This will include: chromosome aberrations and their impact on tissue function, their persistence and function in biological dosimetry, modes of cell death, proliferative function inactivation, perturbation of intra- and inter-cellular signalling, “non-targeted” effects (bystander, genomic instability, adaptive response, etc.). Particular attention will be given to the dependence on radiation quality. Different approaches and methods will be introduced and compared, for modelling radiobiological effects: stochastic (e.g. Monte Carlo) vs deterministic (e.g. based on differential equations), discrete vs continuous, macroscopic vs microscopic, predictive vs exploratory etc.. Radiation will be studied as a perturbation of a complex (biological) system. A multi-scale approach will characterize the course and a general introduction on systems radiation biology and its methods will be presented. Applications will be in particular on radiation risk estimation at low doses, and on clinical radiobiology for optimizing medical uses (e.g. in radiology, and in existing and emerging techniques in radiotherapy). A laboratory part is also planned, in the laboratory of Radiation Biophysics and Radiobiology of the Physics Department.
Teaching methods	=
Reccomended or required readings	D. Alloni, L. Mariotti and A. Ottolenghi. Chapter 1 - Early events leading to radiation induced biological effects. In: Radiation Biology and Radiation Safety, Radiation Biology, J Hendry edt., Vol 8 of the Comprehensive Biomedical Physics series . Elsevier. In press, (2014). Eric J. Hall, Amato J. Giaccia, Radiobiology for the Radiologist Various review papers Slides provided to students
Assessment methods	Oral examination. During the oral examination the basic aspects and applications of radiobiology presented during the course, will be discussed and deepened.
Further information	Oral examination. During the oral examination the basic aspects and applications of radiobiology presented during the course, will be discussed and deepened.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile