Radiobiology and Radiation Biophysics

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Jacopo Morini, Biologist
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Vere Smyth, Physicist

Sofia Barbieri, PhD student, Physics
Mattia Siragusa, visiting PhD student, Physics

...and in collaboration with the Biology Departments, UniPv

The group carries on experimental and theoretical studies on ionizing radiation effects (particularly after low doses), with applications in the clinical use of radiation for diagnostics and therapy (including the risk of complications and secondary tumours) and radiation protection:

* investigation and modeling of mechanisms of radiation action on biological structures from the sub cellular to the systemic level

* use of radiation as a probe to test the response of biological systems to perturbing agents

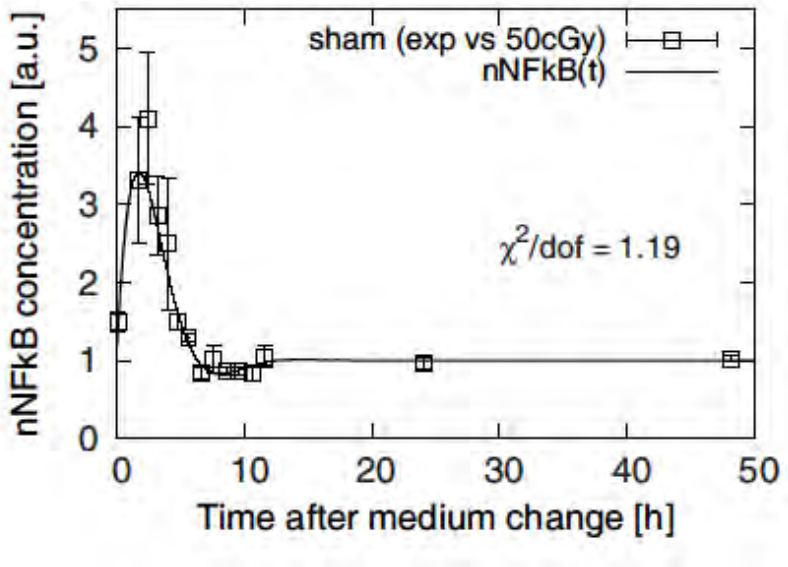
Involvement of the group in Research and Training EURATOM Programmes in the 7th Framework and in HORIZON 2020

Local (UniPV) scientific management of the EURATOM projects CONCERT (with coordination of the WP on E&T), OPERRA, EUTEMPE-RX, ANNETTE, DoReMi (with coordination of the WP on E&T), EPIRADBIO.

EU coordination of ANDANTE, ALLEGRO.

Examples of research topics and activities
(with selected recent publications)

Intra- / Extra-cellular signalling pathways (*e.g.* NF-kB, cytokines)



G. Babini *et al.*, *In vitro γ-ray-induced inflammatory response is dominated by culturing conditions rather than radiation exposures.*
Scientific Reports 5, Art. no.: 9343 doi:10.1038/srep09343, pp 1-7 (2015).
http://www.nature.com/srep/2015/150320/srep09343/pdf/srep09343.pdf

Individual radiosensitivity (e.g. radiosensitivity in rare diseases)

J. Morini *et al.*, *Radiosensitivity in lymphoblastoid cell ines derived from Shwachman-Diamond Syondrome Patients*
Radiation Protection Dosimetry (2015), Vol. 166, No. 1–4, pp. 95–100

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Examples of research topics and activities
(with selected recent publications)

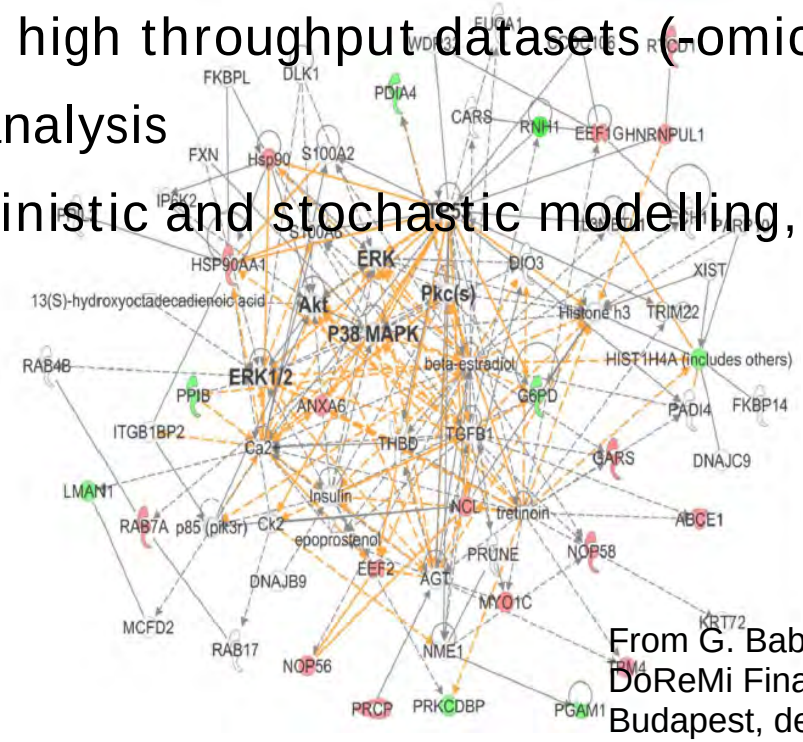
DNA damage & repair

L. Mariotti *et al. Use of the γ-H2AX Assay to Investigate DNA Repair Dynamics Following Multiple Radiation Exposures.* PLoS ONE 8 (11): e79541. doi:10.1371/journal.pone.0079541 (2013).

Bioinformatic analysis of high throughput datasets (-omics)

High throughput image analysis

Systems biology (deterministic and stochastic modelling, integration of datasets, etc.)



From G. Babini's presentation at the DoReMi Final Meeting, Budapest, december 2015

Examples of research topics and activities
(with selected recent publications)

Early and late health risks to normal/healthy tissues including secondary tumors

K Trott, W Doerr , A Facoetti, J Hopewell, J Langendijk, P van Luijk, A Ottolenghi and V Smyth
Biological mechanisms of normal tissue damage: importance for the design of NTCP models
Radiotherapy and Oncology Radiotherapy and Oncology 105 79–85 (2012)

Simulation of the action of different radiation qualities at different scales - from the macroscopic scale with transport calculations to cellular and sub cellular scale with track structure simulation and evaluation of damage to cellular targets as DNA

e.g. cellular damage induction by secondary neutrons produced in particle therapy and evaluation of their biological effectiveness as a function of energy

A. Ottolenghi, V. Smyth, K. Trott. *Assessment of cancer risk from neutron exposure - the ANDANTE project.*
Radiation Measurements 57, 68-73 (2013)

G. Baiocco *et al.*, *Reaction Mechanism interplay in determining the biological effectiveness of neutrons as a function of energy,* Radiation Protection Dosimetry (2015), Vol. 166, No. 1–4, pp. 316–319

e.g. cellular damage induction by radionuclide intake dependent on cellular localization of the emitting source

D. Alloni *et al. Modelling dose deposition and DNA damage due to low energy β emitters.*
Radiation Research, 182, 322–330 (2014)

INFRASTRUCTURES & EQUIPMENTS

Radiobiology LAB in the Physics Department

and easy connection and access to Labs of UniPv Departments and research facilities, including *CENTRO GRANDI STRUMENTI*

WB, ELISA, Fluorescence microscopy, Flow cytometry, qRT-PCR, EMSA

NGS, Confocal microscopy, GC-MS

Close facilities:

X-rays facility (LINAC 6MV, in collaboration with IRCCS S. Maugeri)

C ions facility (CNAO, *Centro Nazionale di Adroterapia Oncologica*)

Laboratory of Applied Nuclear Energy (*LENA*) - TRIGA Mark II Research Nuclear Reactor, UniPv