

Academy of Sciences of the Czech Republic

Nuclear Physics Institute
Dept. of Radiation Dosimetry
Prague, Czech Republic



<http://www.ujf.cas.cz/>



Research programmes:

- ✓ Experimental microdosimetry
- ✓ Radioecology
 - anthropogenic influences in the environment
- ✓ External exposure to natural radiation
- ✓ Radiation biophysics

- Development, testing and the use of the methods for dosimetry, microdosimetry and LET spectrometry in heavy charged particle and high energy radiation beams and fields
- On-board space- and aircraft dosimetry and microdosimetry
- Theoretical modeling of radiation effects at the nm - μm level (DNA damage, energy distributions as a function of sensitive site dimensions, etc.)

Radiation Biophysics Group

Marie Běgusová

Ph.D. students:

Zdenka Palajová, Jakub Kozelka, Viktorie Štísová

Undergraduate students:

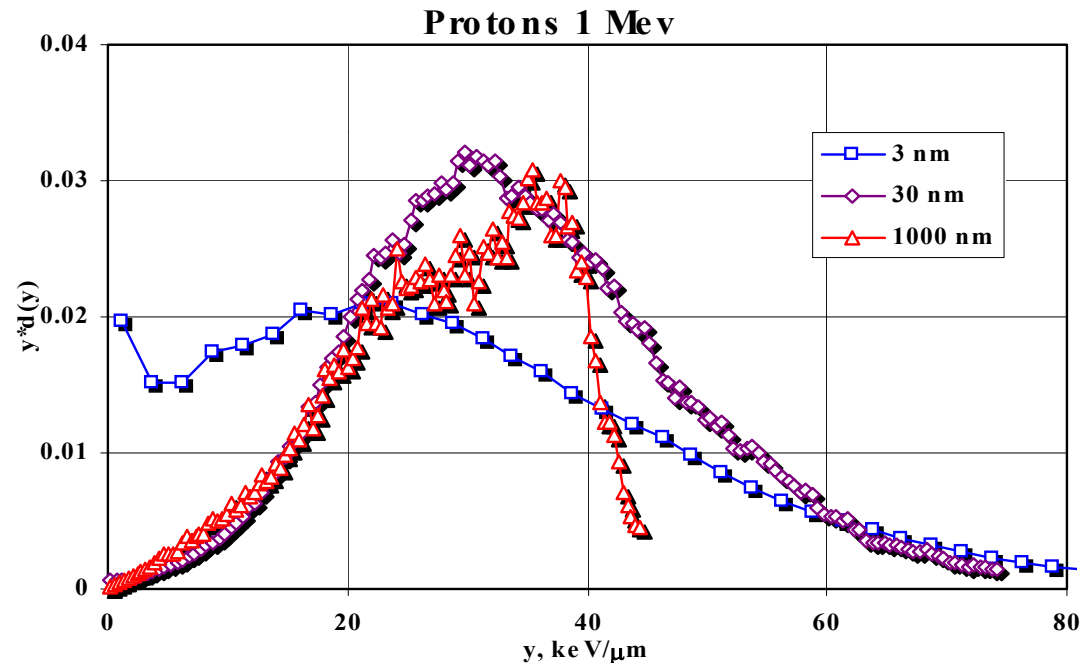
Václav Štěpán, Anna Plavcová

I. Track structure modeling

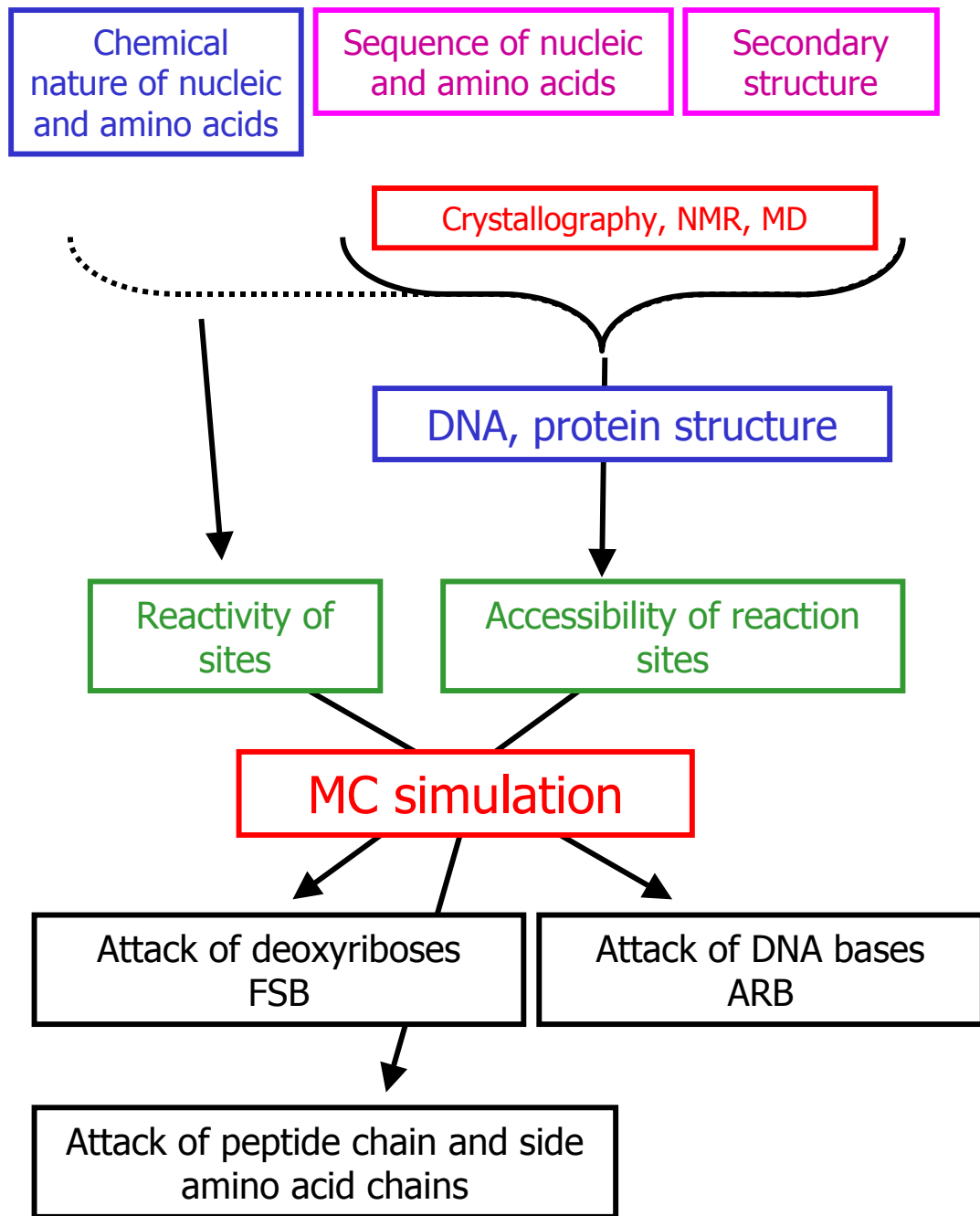
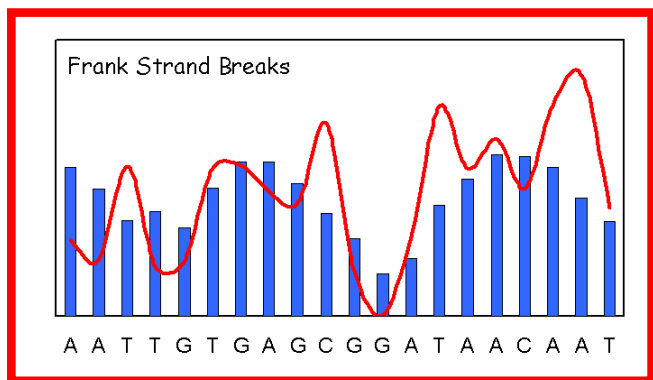
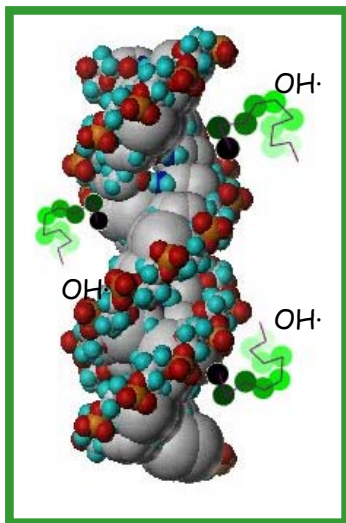
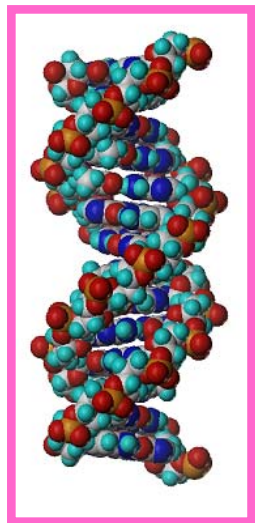
- γ , electron, charged particles
- microdosimetry characteristics
- radiation chemistry modeling

II. Modeling of indirect effects of ionizing radiation

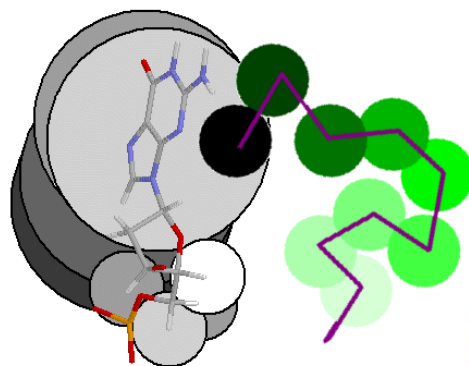
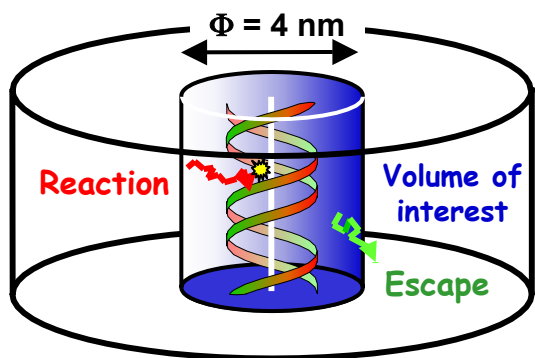
Influence of sensitive volume dimensions on the microdosimetry energy distributions



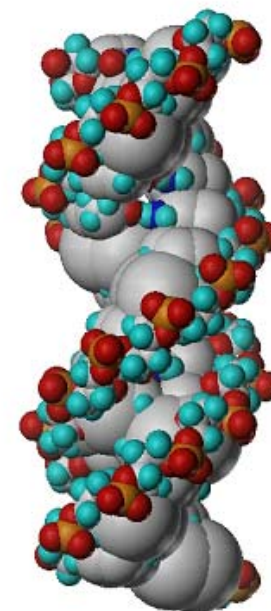
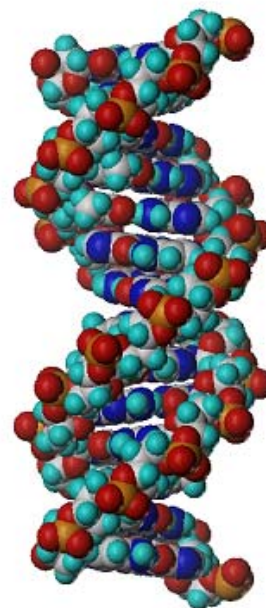
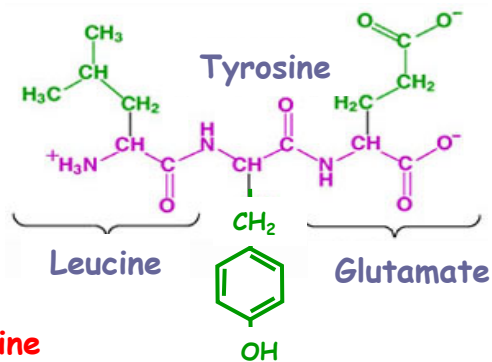
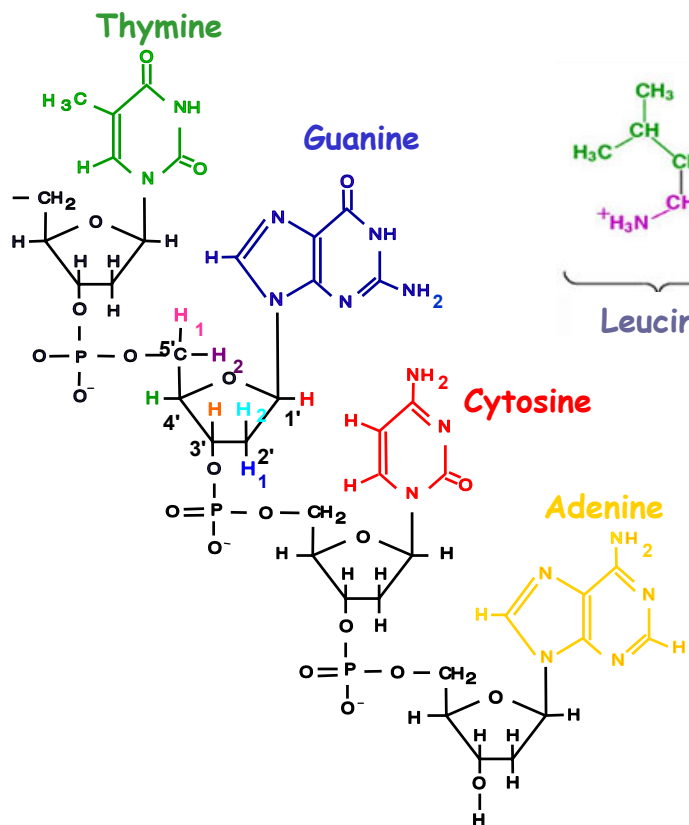
Radack methodology



Simulation of radical diffusion and chemical reactions



$$r_{A,B} = \frac{k}{4\pi(D_A + D_B)N}$$



Attack by OH radicals
 - abstraction of H atoms from the sugar moiety
 - addition to bases

Attack by solvated electrons
 - addition to heterocycles

Results

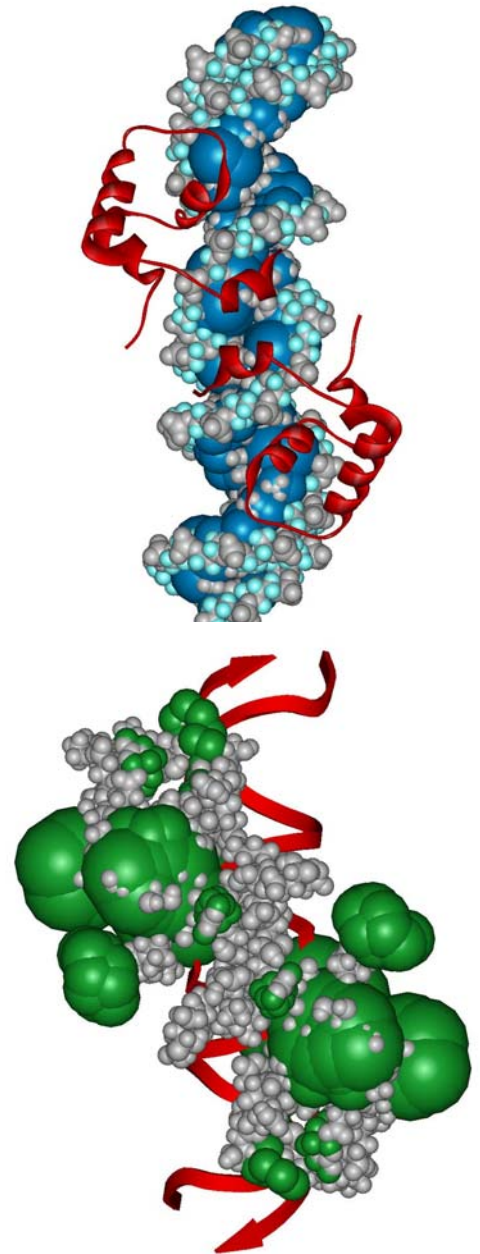
The model has been recently applied to study radiolysis of different DNA conformations:

- single-, double-, triple- DNA
- quadruplex, Z-DNA, nucleosome

and DNA-protein complexes:

- lac operator – lac repressor
- DNA complexes with glycosylases Fpg and HOGG1.

Theoretical modeling is a complementary source of information about the yields of damages caused by ionizing radiation: composition, size, structural and functional consequences. The actual version of stochastic model Radack can predict sequence-, structure-, ligand-dependent modulation of damages caused by the radical attack within DNA, proteins and their complexes .



Institute of Biophysics Brno, Czech Republic

<http://www.ibp.cz/>



Research programmes

- ✓ Biophysical Chemistry of Macromolecules
- ✓ Biophysics of Nucleic Acids Complexes
- ✓ Biophysics and Bioinformatics of Genomes
- ✓ Molecular Cytology and Cytogenetics
- ✓ Kinetics of the Cell Populations

Laboratory of Molecular Cytology and Cytometry

Investigation of dynamic structures in living cells visualizing both proteins and genetic structures, physico-chemical states of chromatin such as acetylation, methylation of histones and DNA, presence of HP1 and other proteins, degree of condensation, etc in relation to gene expression, changes of expression and chromatin due to the induction of fusion proteins, etc.



Laboratory of Molecular Cytology and Cytometry

Kozubek Stanislav (head of the group)

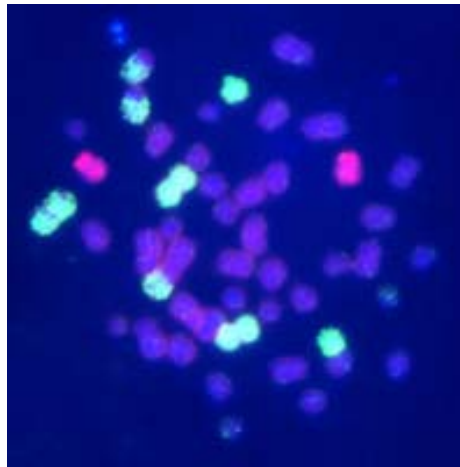
Molecular cytology and cytometry, dynamic chromatin structure and nuclear architecture, tumor biology, radiation biology

Lukasova Emilie (Molecular cytogenetics, tumor biology, radiation biology), Bartova Eva (Cell differentiation, chromatin structure and gene expression), Falk Martin (Chromatin structure and gene expression), Gajduskova Pavla (Chromatin structure, ionizing radiation, DNA microarrays), Harnicarova Andrea (In vivo studies using quantum dots), Ondrej Vladan (In vivo studies of chromatin structure and nuclear architecture, HMG proteins), Technical Assistants: Fucikova Vladimira, Krivankova Hana

Possible input to the COST project:

- Radiation damage to chromatin structure
- Repair of the radiation damage at molecular level (function of proteins related to chromatin, visualization by GFP or RFP)

FISH 2-D



3-D

