Report on Activities of COST ACTION P9 Radiation Damage (RADAM) 2005-6

1. Introduction

The COST Action P9 on Radiation Damage was launched in November 2003 in Brussels where the Management Committee was established as follows;

Chair: Prof. Nigel Mason, Open University, UK
Vice Chair: Prof Michel Farizon, University of Lyons, France

The MC is composed of National Representatives from the signatory nations,

Austria

Prof. Dr. Tilmann Märk
Institut für Ionenphysik
Universität Innsbruck
Technikerstraβe 25
A - 6020 Innsbruck
Tel. +43 512 507 6240
Fax +43 512 507 2532
Email: tilmann.maerk@uibk.ac.at

Prof. Paul Scheier
Institut für Ionenphysik
Universität Innsbruck
Technikerstraβe 25
A - 6020 Innsbruck
Tel. +43 512 507 6241
Fax +43 512 507 2932
Email: paul.scheier@uibk.ac.at

Belgium

Dr. Marie-Jeanne Hubin-Franskin
Université de Liège Faculté de Sciences
Département de Chimie
Laboratoire de Spectroscopie d'électrons diffusés
Allée de la Chimie 3 - bât. B6c
B - 4000 Liège
Tel. 32 4 3663421
Fax 32 4 3662941
Email: mjfranskin@ulg.ac.be

Prof. Nathalie Vaeck
Université Libre de Bruxelles
Faculté des Sciences
Campus de Solbosch CP 160/09
Avenue F.D. Roosevelt 50
B- 1050 BRUXELLES
Tel : +32-2-650 47 28
Fax : +32-2-650 42 32
Email: nvaeck@ulb.ac.be

Bulgaria

Prof. Bojidar Galutzov
Department of Biophysics and Radiobiology
Biological Faculty,
Sofia University "St. Kliment Ohridsky"
8, Blvd. Dragan Tzankov
BG - 1164 Sofia
Tel : +359 2 6330 237; +359 2 666 223
Fax : +359 2 656 641
Email: galutzov@biofac.uni-sofia.bg

Ms. Galina Kurchatova
National Centre for Radiobiology and Radiation Protection
132, Sv. Kliment Ohridski Blvd.
BG - 1756 Sofia
Tel : +359 2 626 037
Fax : +359 2 621 059
Email: ncrrp@ncrrp.org

Denmark

Dr. David Field
Department of Physics and Astronomy
Ny Munkegade, Building 520
University of Aarhus
DK - 8000 Aarhus C
Tel. +45 89 42 35 60
Fax +45 86 12 07 40
Email: dfield@phys.au.dk

Dr Steen Brønsted Nielsen
Department of Physics and Astronomy
Ny Munkegade, Building 520
University of Aarhus
DK - 8000 Aarhus C
Tel. +45 89 42 48 79
Fax +45 86 12 07 40
Email: sbn@phys.au.dk

France

Prof Michel Farizon
Institut de Physique Nucléaire de Lyon
Bâtiment Paul Dirac
Domaine scientifique de la Doua
4, rue Enrico Fermi
F - 69622 - Villeurbanne
Tel. +33 4 72 44 84 01
Fax +33 4 72 44 80 00
Email: mfarizon@ipnl.in2p3.fr

Dr Marie-Christine Bacchus
Chargée de Recherche CR1
Laboratoire de Spectrométrie Ionique et Moléculaire
UMR CNRS 5579
Bâtiment Alfred Kastler
43, boulevard du 11 novembre 1918
F - 69622 - Villeurbanne Cedex
Tel. +33 4 72 43 10 83
Fax +33 4 72 43 15 07
Email: bacchus@lasim.univ-lyon1.fr

Germany

Prof. Nikolaus Stolterfoht
Abteilung Struktur und Dynamik
Hahn-Meitner-Institut (HMI)
Glienicker Str. 100
D - 14109 Berlin
Tel. +49 30 8062 2340
Fax +49 30 8062 2293
Email: stolterfoht@hmi.de

Prof. Dr. Herwig Paretzke
Institut für Strahlenschutz
GSF-Forschungszentrum für Umwelt und Gesundheit
Ingolstädter Landstrasse 1
D - 85764 Neuherberg
Tel. +49 89 3187 4006
Fax +49 89 3187 3323
Email: paretzke@gsf.de

Ireland

Dr. Kevin G. McGuigan
Dept. of Pharmaceutical Chemistry and Biophysics
Royal College of Surgeons in Ireland
123 St. Stephen's Green
IRL - Dublin 2
Tel. 353 1 402 2207
Fax 353 1 402 2168
Email: kmcguigan@rsci.ie

Dr. Fiona Lyng (Replaced Dr O'Neill)
Radiation and Environmental Science Centre
Dublin Institute of Technology
Kevin Street
Dublin
Ireland
Tel. +353 1 402 7972
Fax. + 353 1 402 7904
Email: fiona.lyng@dit.ie

Latvia

Dr. Rita Plukiene
Institute of Physics
Savanoriy pr. 231
LT - 2001 Vilnius
Tel. 370 5 266 1654
Fax 370 5 260 2317
Email: rita@ar.fi.lt

Ms Bytaute Remeikyte
Department of Plant Physiology and Microbiologyl and Leather Technology
Faculty of Natural Sciences
Vilnius University
Ciurliono 21/27
LT- Vilnius 2009
Tel 00370 5 2398205 or 2398206
Fax 00370 5 2687096
Email: bytaute@ar.fi.lt

The Netherlands

Prof. Thomas Schlathölter
KVI Atomic Physics
Zernikelaan, 25
NL - 9747 AA Groningen
Tel. 31 50 3635099
Fax 31 50 3634003
Email: Tschlat@KVI.NL

Prof. Dr. Reinhard Morgenstern
KVI Atomic Physics
Zernikelaan, 25
NL - 9747 AA Groningen
Tel. 31 50 3633564
Fax 31 50 3634003
Email: Morgenstern@KVI.NL

Poland

Prof. Krzysztof Bobrowski
Institute of Nuclear Chemistry and Technology
Department of Radiation Chemistry and Technology
16 Dorodna, str.
PL - 03-195 Warsaw
Tel: +4822 811 12 28
Fax: +4822 811 15 32
Email: kris@orange.ichtj.waw.pl

Dr. Marian Wolszczak
Institute of Applied Radiation Chemistry
Technical University of Lodz
15, Wroblewskiego str.
PL – 93-590 Lodz
Tel: +4842 631 31 88
Fax: +4842 684 00 43
Email: marianwo@mitr.p.lodz.pl

Portugal

Dr Paulo Limao-Vieira
Department of Physics
New University of Lisbon
Quinta da Torre, 2829-516
Caparica
Tel: + 351 - 21 294 85 76
Fax:+ 351 - 21 294 85 49
Email: plimaovieira@fct.unl.pt

Slovakia

Prof. Stefan Matejcik
Department of Plasma Physics
Comenius University
Mlynska dolina F2
84248 BRATISLAVA
Tel: + 421-2-60295686
Fax: + 421-2-65429980
Email: matejcik@fmph.uniba.sk

Prof. Jan Skalny
Department of Plasma Physics
Comenius University
Mlynska dolina F2
84248 BRATISLAVA
Tel: + 421-2-60295686
Fax: + 421-2-65429980
Email: skalny@fmph.uniba.sk

Spain

Prof. Gustavo Garcia Gomez Tejedor
Consejo Superior de Investigaciones Científicas (CSIC)
Instituto de Matemáticas y Física Fundamental (IMAFF)
C/Serrano 121
E - 28006 Madrid
Tel. +34 91 561 68 00 (Ext. 2402)
Fax +34 91 585 48 94
Email: g.garcia@imaff.cfmac.csic.es

Dr Luis Vazquez Martinez
Universidad Complutense de Madrid
28040 Madrid
Tel:+34 91 3947612/4449
Fax:+34 91 3947510
lvazquez@fdi.ucm.es

United Kingdom

Prof. N.J. Mason
Department of Physics and Astronomy
The Open University
Walton Hall
Milton Keynes MK7 6AA
Tel. 44 0 1908 655132
Fax 44 0 1908 654192
Email: n.j.mason@open.ac.uk

Prof. Melvyn Folkard
Gray Cancer Institute
Mount Vernon Hospital Northwood
Middlesex HA6 2JR
Tel. 44 0 19238 28611
Fax 44 0 19238 35210
Email: Folkard@graylab.ac.uk

Further countries joining the action in 2004 were ;

Czech Republic

Dr Marie Begusova
Nuclear Physics Institute
Radiation Dosimetry Department
Na Truhlarce 39/64
180 86 Prague 8
Czech Republic
Tel: +420 283 842 791
Fax: +420 283 842 788
Email: begusova@ujf.cas.cz

Doc. RNDr. Stanislav Kozubek, DrSc.
Institute of Biophysics AS CR
Královopolská 135
612 65, Brno
Czech Republic
Tel: +420 541 517 111
Fax: +420 541 211 293
Email: kozubek@ibp.cz

Hungary

Dr. Béla Sulik
Institute of Nuclear Research

Dr Ágnes Vibók
University of Debrecen
Dept. of Theoretical Physics

Hungarian Academy of Sciences
Bem tér 18/c
H-4026 Debrecen
Tel: +36 52 417 266
Fax: +36 52 416 181
Email: sulik@atomki.hu

Debrecen

Email: vibok@phys.unideb.hu

Italy

Prof. Maurizio Persico
Dipartimento di Chimica e Chimica Industriale dell'
Universita di Pisa
Via Risorgimento 35
I-56126 Pisa
Tel: +39 050 2219 243
Fax: +39 050 2219 260
Email: mau@dcci.unipi.it

Prof. Massimo Olivucci
Dipartimento di Chimica e Chimica Industriale dell'
Universita di Siena
Via A. Moro
I-53100 Siena
Tel: +39 0577 2342 74
Fax: +39 0577 2342 78
Email: olivucci@unisi.it

Serbia

Dr. Bratislav P Marinkovic
Institute of Physics
Centre for Atomic and Subatomic Physics
Laboratory for Atomic Collisions processes
P O Box 68 Serbia and Montenegro
YU-11080 Belgrade
Tel :+381 11 316-0882 or 316-0260 ext.131 or 154
Fax :+381 11 316-2190
Email: bratislav.marinkovic@phy.bg.ac.yu

Sweden

Prof Henrik Cederquist
Fysikum
Stockholms universitet
AlbaNova Universitetecentrum
106 91 Stockholm
Tel: 08-5537 8625
Email: cederquist@physto.se

These signatories were confirmed at the Steering meeting held at first COST RADAM meeting in Lyons in July 2004.

Iceland and Israel in 2005 applied to join the action and the MC agreed that they be added to the Action. In 2006 Greece applied to join the Action and will be represented in 2007 by **Dimitris Emfietzoglou**

Iceland
Professor Oddur Ingolfsson
University of Iceland
Science Institute
Dunhaga 3
107-IS Reykjavik
Tel. + 354 5254313
Fax. +354 5528911
Email: odduring@hi.is

Mr. Garðar MýRDAL
Landspitali University Hospital
Dept. of Radiation Physics
Building K
105 Reykjavík
Tel. +354 543 6817
Fax. +354 543 4803
Email: gardar@landspitali.is

Israel
Prof. Brenda Laster H.
Dept. of Nuclear Engineering
Ben-Gurion University of the Negev
POB 653
84105 Beer Sheva
Tel. +972 8 646 1317
Fax. +972 8 647 2955
Email: blaster@bgu.ac.il

2. RADAM Meetings and WG Meetings ;

The Action is organized through five working groups
WG1: Electron and biomolecular interactions (Chair; D Field)
WG2: Ions and biomolecular interactions (Chair; T Schlathölter)
WG3: Radiation in physiological environments (Chair; K McGuigan
WG4: Theoretical developments for radiation damage (Chair; M Bacchus)
WG5: Track Structure in cells (Chair; H Paretzke)

The working groups both host their own meetings and arrange dedicated session at the Annual RADAM meeting. A list of the participants in each WG are listed on the website http://www.isa.au.dk/networks/cost/

WG Meetings in 2005-7

WG1: *Electron and Biomolecular interactions*,

WG1 did not hold a separate meeting in 2005 since many of the WG members were also members of a Framework V Network (EPIC) and ESF Programme (EIPAM) which held a joint meeting 25th-30th June 2005, San Martino al Cimino, Viterbo, Italy. Here results of collaborative work within the RADAM Action were reported.

The Second WG1 workshop 23rd-26th February, 2006 was held in Altis Park Hotel, Lisbon, Portugal. Organised by Dr P Limao-Vieira some 35 participants attended. The main theme being the study of electron damage to biomolecules and its role in DNA Damage.

In 2007 WG1 Organized a joint meeting with WG3 entitled 'Symposium on Radiation Effects of Biomedical Interest' 22nd to 25th February 2007, CSIC Madrid, Spain. The main aim of this meeting was to bring together academic researchers with clinical staff working in radiography departments (hence one day was hosted by La Paz hospital in Madrid). A very successful meeting it has led to the preparation of a proposal for a Training network in radiation sciences for Framework VII programme. 48 people attended.

WG2: *Ions and Biomolecular interactions*,

In 2005 WG2 held a small workshop (30 participants) immediately after the Annual meeting in Postdam 21 attendees with 7 presentations

WG2 held an International Workshop on Radiation Damage of Water St Malo, France 14th-16th May 2006. This meeting was a result of an extensive research programme to study ion interactions with water by WG2 researchers, some 35 people attended(including french students)

WG3: *Radiation in physiological environments*

WG3 arranged two meetings in 2005. The first was a small meeting organized by the WG Chair in Dublin April 1-2 (a dozen attendees) on the use of radiation in water sterilization, a topical issue following the devastating tsunami in Asia in early 2005. This work was subsequently presented in Brussels at COST meeting. The second WG3 meeting was held as part of the EYIC European Young Investigator Conference at Gniezno, Poland June 7-12. Chaired by Prof Krzysztof Bobrowski http://www.ichtj.waw.pl/sulfrad/EYIC2005/ comprising 34 lectures and over 50 posters with over 70 attending.

In 2006 WG3 co-hosted aSymposium on Radiation Effects of Biomedical Interest 22nd to 25th February 2007, CSIC Madrid, Spain. (See above)

WG4: *Theoretical developments for radiation damage*

The WG held a round Table meeting WG4, Gröningen, June 6th 2006 after the Annual meeting and later this year will host a workshop on Theoretical Developments for Radiation Damage, Fréjus, France 21st -22nd September 2007, Fréjus, France

WG5: *Track Structure in cells*
The working group was responsible for co-arranging the COST Supported: 14th International Symposium on Microdosimetry (MICROS 2005) November 13-18, 2005, Venezia-Italy

An Interdisciplinary Meeting on Ionising Radiation Quality, Molecular Mechanisms, Cellular Effects, and Their Consequences for Low Level Risk Assessment and Radiation Therapy. Attended by over 200 delegates in excess of 70 presentations were made and more than 140 posters. Here the modeling issues of radiation track damage were fully discussed as were many issues related to he RADAM programme with emphasis upon the application of such work to radiotherapy .

The WG met in Bad Honnef, Germany 16-19 October; the meeting was entiutled 'Challenges for Modelling of Radiation Damage in Cells' was held in the Physik-Zentrum Bad Honnef, Germany. The workshop was aimed at a presentation and discussion of various research areas where experimental results challenge present biophysical modelling approaches and was held with work package 5 of RISC RAD and a new steering group within RISC-RAD a Major EU funded programme in Radiation Damage (Under Integrated Project Themes of Framework VI)

http://www.riscrad.org/scripts/home/publigen/content/templates/show.asp?L=EN&P=169&vTicker=alleza,100,Latest%20news

RADAM Annual Meetings:

The first Management Committee agreed that each Year there should be an Annual meeting of the Action hereafter known as the RADAM meeting and that the Management Committee would meet at each Annual meeting.

The first Annual meeting was held in Lyons 24th to 27th June, 2004 (http://costp9-radam.in2p3.fr/index.html) with the Vice Chair Prof M Farizon acting as local Chair. A full report of the meeting may be found on the Action website. The meeting attracted more than 100 participants. Each WG was asked to put together a programme of 34 talks and there was a large poster session.

The meeting was judged a great success and successfully launched the Action and began the formation of a RADAM community. However it was apparent that the community required being so wide was a 'common community separated by language'. Therefore it was decided that it was necessary to arrange a more tutorial led meeting at the Second RADAM meeting in 2005

The Second Annual meeting (RADAM05) was held in Potsdam March 17 to 20, 2005 http://www.radam05.org. attracting 72 participants.In accordance with the discussion at the First RADAM meeting this was arranged more as a workshop to provide tutorial style talks for the community. Each WG was requested to provide two speakers who could both provide an overview of their field and provide a tutorial on the terminology and basic background knowledge of their particular discipline. This was very successful and has led to he creation of a 'RADAM community' and several excellent examples of cross disciplinary co-operation. The meeting also contained several reports of RADAM members on projects begun as a result of STSMs, a total of 28 talks were presented and 35 poster presentations by students on their ongoing work.

The Third Annual meeting (RADAM06) was held 6th-9th June 2006, Groningen, The Netherlands with participants and 36 oral presentation and 31 poster presentations many of which reported results of research undertaken as part of the STSM programme. The conference demonstrated the Action's success in developing cross disciplinary research and the rapid developments of the research field.

In addition in Spetmber 2006 many of the Cost MC (and others) met in a co-sponsored meeting with ESF Programme (EIPAM) in Malta 16th-20th September 2006, Valletta, Malta Attracting 112 participants with 49 talks and 37 posters.

The Fourth Annual RADAM meeting (RADAM07) will be held in Dublin 19 to 22 June with the first day dedicated to tutorial workshops for postgraduates and younger researchers. ***http://www.isa.au.dk/networks/cost/radam07/index.html***

The success of this Conference series in bringing together researchers from such otherwise seldom connected communities such that it is agreed to continue thisas an annual series. RADAM08 is scheduled for Debrecen in Hungary

In addition the Action arranged
The 24th Miller Conference on Radiation Chemistry 10-15 September 2005, La Londe les Maures, France (http://web.cnrs-orleans.fr/~webcbm/miller/index.htm). Attended by over 120 participants 22 lectures were presented with a further 13 presentations from Younger researchers and over 60 posters. Several international participants attended and requested to be affiliated to the COST Action including leading US and Canadian Laboratories. These names were presented to the Physics panel for approval and attended 2006 and 2007 meetings..

In 2006 Members of the Action were successful in a bid to the ESF for a Research conference entitled 'Biomolecules from Gas Phase Properties to the Actions Relevant to Living Cells' held 24th-29th June, Obergurgl, Austria. A budget of 50,000 Euros was granted for the meeting and 45 presentations made with over 50 poster – many by members of the COST programme.

The WG1 group also co-organised a workshop entitled;
Biology and Medicine with Low Energy Synchrotron Radiation
1st-3rd November 2006, Aarhus, Denmark for 57 participants.

Finally in December (3-7) 2007 members of WG1,4,5 will combine to host a CECAM workshop in Lyons entitled 'Modelling Radiation Damage' for which a budget of 15000 Euros has be allocated by CECAM.

Details of these meetings can be found on the Action's webpage together with other meetings of interest to the COST RADAM Community.

3 STSMs;

Short Term Scientific Missions have been an essential part of the Action, indeed these were most attractive to the members as they allowed research programme to be developed and new collaborations to be initiated. A first call for proposals was issued in January 2004 and several responses received. Unfortunately changes in staff at the COST office slowed the administration of such awards and many were not processed until later in the year.

At the Lyons meeting the New COST Adminstrator, Ms S Beauloye, attended the meeting and reported the new arrangements for STSMs encouraging applications. The Action proved to be extremely popular and engendered many STSM applications (over 60 in all) before the COST office in March 2005 announced that no more STSM's could be hosted in 2005. *A full list of the 75 STSM's held in 2004/5 was attached to the previous report (2004-5).*

In 2005-6 changes within COST restricted the number of STSMs that can be held but the MC continued to support these to these and dedicated around 40% of the budget to these activities with the recommendation that they should be for a maximum of 2 weeks and that no group should host more than one in any one year. However late in both 20065 and again in 2006 the COST office found some additional resources for STSMs - which the RADAM Community rapidly utilized. In 2007 we again have given priority to STSMs and a recent call by the office for new STSMs to be held by end of May is receiving widespread support.

A full list of the now nearly 120 STSMs funded in this Action is being prepared on the Action Website together with final reports and will form the basis of the final Report of the Scientific outcome of this Action.

We recognise that the Action is therefore perhaps unique in its level of STSM activity but we believe that these are the most valued activity of the Action and the most scientifically productive - leading to a large number of publications and has led to a new and innovative RADAM research community developing across Europe.

Further EU applications;

The COST Action has led to the development of a larger European community seeking to develop research in radiation damage. This has led to several ideas for projects suitable for EU Framework VII support, 16 members of the Action have combined to submit an application for a Marie Currie Initial Training Network. A larger submission for an ESF Programme on Radiation Damage was submitted in November 2006 and in 2007 the topic may be developed as an application for an ESF EUROCORE project.

COST RADAM Review Publication 2007

In 2007 we were invited to publish a review on 'Topics in Radiation Damage' as a monograph with Canopus books a subsidiary of Springer Verlag. To comprise of 10 longer reviews and 25 'hot topics' it will be a modern review of the current status of our knowledge f both physical and chemical processes leading to Radiation Damage of DNA and Cellular systems (for publication November 2007).

Scientific Progress:

A full scientific review is in preparation for the Final MC meeting to be held in RADAM07 in Dublin. A brief review/update is therefore given here

WG1 Some of the most dramatic progress in the course of the Action has been in the study of electron scattering from bio-molecules in particular the DNA bases adenine, cytosine, guanine, thymine and RNA base uracil and most recently the larger biomolecules including glycine, simple sugars and acids. The University of Innsbruck (UIBK) and Free University of Berlin (FUB) have shown that dissociative electron attachment is a dominant process at low electron energies and is both bond (C-H versus C-N) and site selective (N1-H versus N3-H) in the DNA bases. These pioneering results suggest that may be possible to explore DNA damage at a basic molecular level. Indeed recent work by FUB, UIBK and Open University (OU) has demonstrated a correlation between electron attachment rates to biomolecules and their carcinogenicity and may be used to suggest new compounds to be adopted in radiation therapy as treatment enhancing sensitizers, e.g. 5-bromouracil. Complementary theoretical calculation (performed by La Sapienza University Rome) on the dynamics of Uracil fragmentation after electron attachment has likewise been published in PRL and received widespread publicity. These results provide significant consequences for the molecular description of genotoxic effects in living cells due to low-energy electrons, which are found to be the most abundant secondary species formed from ionizing radiation.

Through STSMs the Action has helped to develop a strong programme in the study of spectroscopy and dissociation dynamics of biomolecules under electron and photon impact. This work has been led by the OU, New University of Lisbon, Institute of Physics Belgrade, Comenius University Slovakia and University of Iceland. Studies on the effect of the local media on dissociation dynamics has led to several surface science type experiments being developed (e.g. by University of Paris-Sud and Free University Berlin (a fruitful collaboration funded by STSMs)

The use of photons and synchrotron radiation to explore biomolecular structure and DNA damage has also been pursued under the remit of WG1. Recent results by OU and University of Aarhus have provided new quantitative results of DNA damage as a function of UV dose, information that may be used in epidemological models.

Such pioneering research has led to an active and growing international research community, *one in which the EU is recognised as amongst the most active and leading members*.

WG2 In similar way to WG1 had developed a series of collaborative projects with Groningen, Queens University of Belfast and GNIL Caen cooperating on ion impact studies of nucleotide bases and, co-operating with HMI Berlin and ATOMKI Hungary, in the study of ion induced fragmentation of water. Indeed so much data was collected on water that this was the topic of its own workshop in 2006. The collaborative work in Groningen had also led to the exciting potential observation of Watson-Crick pair in clusters of the nucleotide bases. Several experiments are now in development to study biomolecules in clusters (Aarhua, Groeningen, Innsbruck and Lyons) as a method for exploring the role of local medium in radiation damage (e.g. in release of OH radical form water embedded in DNA). Once again the ability to co-ordinate such work through STSMs has proven to be invaluable allowing the groups to develop common experimental techniques

WG3 had encouraged a wide variety of visits and collaborations in several areas of Radiation damage including free radical chemistry, protein damage and DNA damage studies as well as several *in vivo* experiments. The importance of bystander effect has been highlighted (Dublin Institute of Technology and Gray Caner Lab, UK) and in late 2006 a new research topic, the study of radiation damage on cellular membranes has emerged. This WG has also resulted in the most applied research with the Chair Dr K McGuigan technique for solar UV water sterilization being featured internationally as a cheap yet effective method for water treatment in poor countries and applicable in regions of Natural Disaster (e.g. tsunami).

WG4 has developed a strong programme to explore and develop computational methods for calculating the electronic states of biomolecules and studying biomolecular fragmentation patterns under different ionizing radiations. Much of the work undertaken in STSMs of WG4 involved a theoretical study of the interaction of ions with biomolecules and photochemistry and photodissociation processes. This work also allows interpretation of experimental results in WG1 and WG2. New advances in ab initio calculations of the potential energy hypersurfaces for the ground state, and especially for excited states have been made. The role played by the triplet excited states, and therefore by the intersystem interaction being demonstrated. The problem of the DNA base staking and its correct ab initio description has also been addressed. This problem is central to the understanding of for example electron migration or ionized stacks of bases in DNA. One of the essential issues when modelling the decay mechanism is the correct location of the important features on the energy landscapes such as minima, transition states or conical intersections. In this sense, nonadiabatic dynamics around conical intersections appears to be more a general mechanism of de-excitation for excited states than an exception. However, a correct choice of both the reaction paths and of the active coordinates defining the nuclear motions are necessary to describe the dynamical processes. The types of processes that were discussed were numerous. These included photodissociation, photoisomerization or intra and inter charge transfer mechanisms to the optimal control of selective photofragmentation to repair DNA mutation or even investigation of the production of multiply charged ions by core excitation of biomolecules. Finally, the inclusion of solvent effects has been investigated. It is important to note that the

biological systems considered are not only the DNA and RNA bases or bases pairs and peptides but also chromophores of protein or of visual pigments.

WG5 has concentrated upon the development of radiation damage models which are of particular relevance to understanding the risk of exposure to different types of ionising radiation. The WG has identified the following key questions;

- At which stages (initiation/promotion/clonal progression) does radiation contribute most to carcinogenesis and is this the same across tissues, radiation qualities, doses and dose rates?
- Which of the three common mechanistic risk projection models is most soundly based upon biological evidence? Carcinogenesis driven by
  - i) Direct targeted DNA damage in single cells
  - ii) Non-targeted damage in single cells
  - iii) Tissue level inflammatory responses
- How can the contribution of inherited factors to individual risks be incorporated into mathematical risk projection models?
- What is the mathematical model for cancer risk projection that is most consistent with available data and what are the operational consequences

STSMs have explored current models and their development and also identified the key fundamental data that is necessary for their improvement (tasks for the other WGS).

NJ Mason
March 2007

Appendix STSMS 2005 and 2006

2004: 49 (See last report)

2005: 23

Limao-Viera, Paulo	Illenberger, Eugen	Jan
Houée-Levin, Chantal	Bobrowski, Krzysztof	17-23 Jan
Garcia, Gustavo	Hubin-Franskin, Marie-Jeanne	26-29 Jan
Lammich, Lutz	Anderson, Lars	1-28 Feb
Staluszka, Justyna	Mayer, Erwin	14-26 Feb
Piechowska, Katarzyna	Desouter-Lecomte, Michele	20 Feb-19 Mar
Celuch, Monika	Houée-Levin,Chantal	1-30 Mar
Labuda, Marta	Bacchus, Marie-Christine	7-30 Mar
Orszagh, Juraj	Mason, Nigel	4-29 April
Schlatholter, Thomas	Scheier, Paul	18-24 April
Mishra, Sabyashachi	Vallet, Valerie	25 Apr-13 May
Stolterfoht, Nikolaus	Sulik, Bela	7-13 May
Skalny, Jan	Maerk, Tilmann	15-25 May
Milosavljevic, Alek	Scheier, Paul	1-30 Jun
Stolterfoht, Nikolaus	Mccullough, Robert	5-11 Jun
Ptasinska, Sylwia	Wolszczak, Marian	6-19 Jun
Stisova, Viktorie	Spotheim-Maurizot, Melanie	19 Sep-16 Oct
Hvelplund, Preben	Huber, Bernd	3-9 Oct
Nielsen, Steen	Huber, Bernd	3-9 Oct
Begusova, Marie	Spotheim-Maurizot, Melanie	15 Oct-4 Nov
Cederquist, Henrik	Hvelplund, Preben	29 Oct-5 Nov
Manil, Bruno	Hvelplund, Preben	29 Oct-5 Nov
Huber, Bernd	Hvelplund, Preben	30 Oct-5 Nov

2006; 22

Richard Balog	Eugen Illenberger	23 Jan.-17 Feb.
Maria Navacchia	Jean Cadet	1-28 Feb.
Joanna Didik	Peter Wardman	4-19 Feb.
Stepan Vaclav	Werner Friedland	3-30 Apr.
Anne Lafosse	Eugen Illenberger	10-28 Apr.
Krzysztof Bobrowski	Chantal Houee-Levin	1-14 May
Maria Boyle	Pilar Fernandez	1-31 May
Ilko Bald	Robert Abouaf	21 May-3 June
Sharon Moore	Hauke Clausen-Schaumann	20-25 June
Malgorzata Smialek	Hauke Clausen-Schaumann	20-25 June
Aoife Lacy	Sixto Malato	9-29 Jul.

Oddur Ingolfsson	Eugen Illenberger	17 Jul.-8 Aug.
Yvette Suzanne Tergiman	Jozef Sienkiewicz	6-12 Sept.
Elena Zaharieva	Fiona Lyng	16-30 Sept.
Jean Louis Rivail	Franco Gianturco	16 Oct.-15 Nov.
Bratislav Marinkovic	Nigel Mason	1-7 Nov.
Maria Raposa	Nigel Mason	1-30 Nov.
Janina Kopyra	Eugen Illenberger	5 Nov.-5 Dec.
Predrag Kolarz	Nigel Mason	11-30 Nov.
Ágnes Vibok	Marie-Christine Bacchus	20-26 Nov.
Anna Acheva	Fiona Lyng	25 Nov.-16 Dec

2007 Estimate >25

Total 119 to date with some 14 in progress