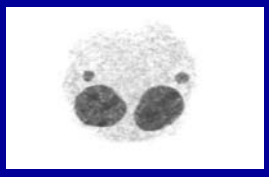
Analysis of chromosomal aberrations in cells exposed to ionising radiation for the purpose of retrospective dose estimation and the assessment of DNA damage

Andrzej Wojcik and Mats Harms-Ringdahl

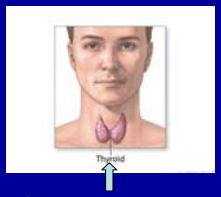
Department of Genetics, Microbiology and Toxicology
Stockholm University, S-106 91 Stockholm, Sweden



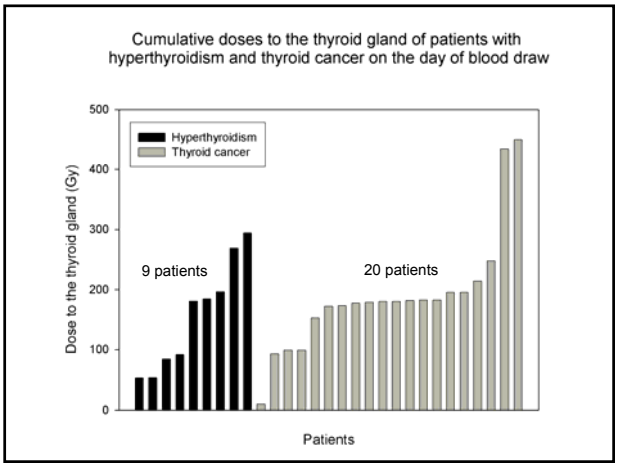
ANALYSIS OF MICRONUCLEI IN PERIPHERAL BLOOD LYMPHOCYTES OF PATIENTS TREATED WITH IODINE-131 FOR THYROID DISEASE

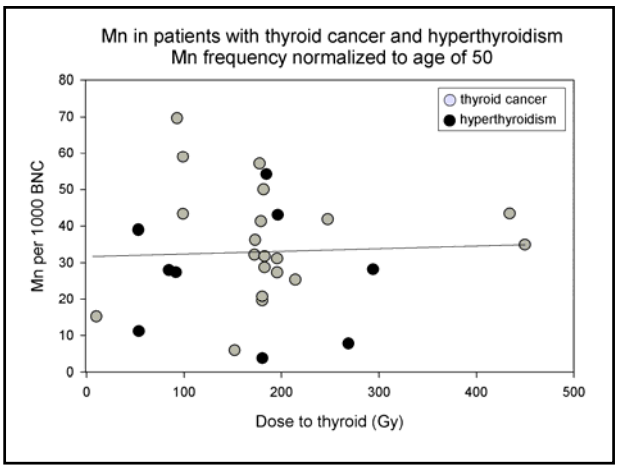
A. Wojcik, S. Sommer, I. Buraczewska, E. Lisiak, S. Siekierzynski, E. Dziuk, M. Bilski, M.K. Janiak

Institute of Nuclear Chemistry and Technology, Warszawa
Military Institute of Hygiene and Epidemiology, Warszawa
Military Medical Institute, Warszawa
Poland



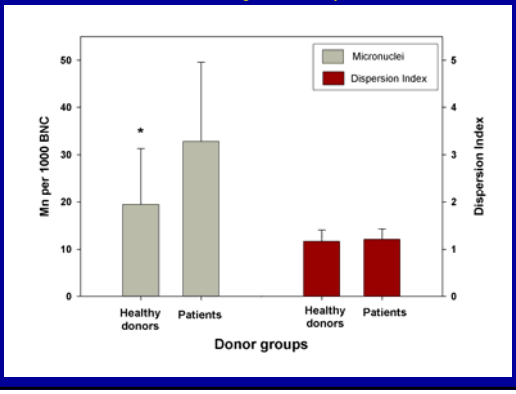
^{131}I activity: 0.16 – 6.6 GBq



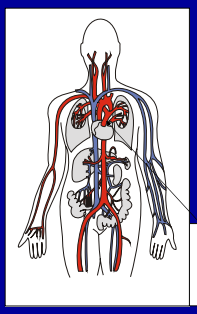


Mean frequencies of micronuclei and mean dispersion indices in lymphocytes of patients and healthy donors.

*** : difference significant with p<0.001**



Enhanced level of micronuclei in peripheral blood lymphocytes of patients treated for restenosis with ^{32}P endovascular brachytherapy



A. Wojcik, I. Buraczewska, S. Sommer, K. Brzozowska, J. Pręgowski, A. Witkowski, D. Garmol, S. Pszona, W. Bulski

Institute of Nuclear Chemistry and Technology, Department of Radiobiology and Health Protection, Warszawa, Poland

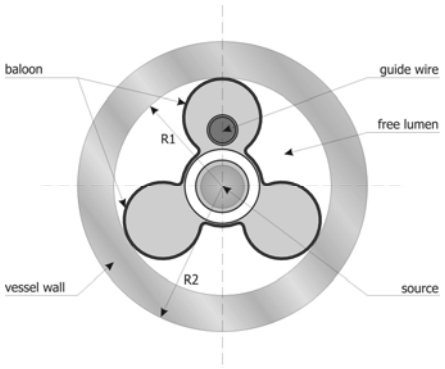
Cardiac Catheterization Laboratory, Institute of Cardiology, Warsaw, Poland

Department of Medical Physics, The Maria Sklodowska-Curie Memorial Cancer Centre and Institute of Oncology, Warsaw, Poland

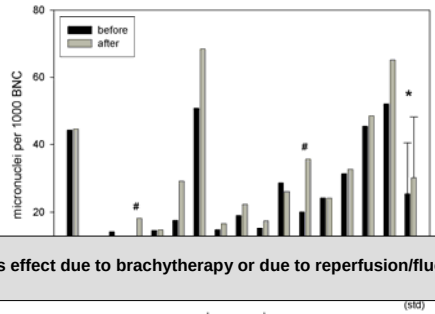
Soltan Institute for Nuclear Studies, Otwock-Swierk, Poland

Stents are inserted to treat coronary closures. In the case of many patients the stents close again due to restenosis.

Schematic view of the vessel cross-section with the centering balloon in position. The balloon lobes are inflated, and the part of the lumen open to blood flow is seen. R1: radius to the endothelial wall, R2: radius to the outside wall of the blood vessel.



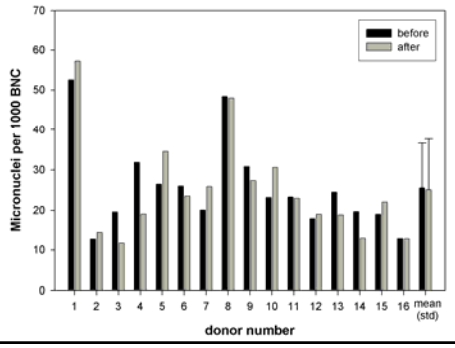
Frequency of micronuclei in lymphocytes of patients treated with P-32 brachytherapy
*: difference significant with p<0.05 (Student`s test)
#: difference significant with p<0.05 (chi-square test)



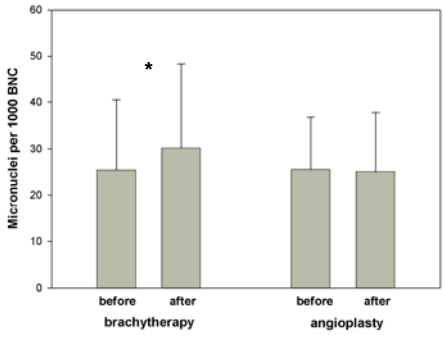
Is this effect due to brachytherapy or due to reperfusion/fluoroscopy?

Frequencies of micronuclei in lymphocytes of patients treated by baloon angioplasty

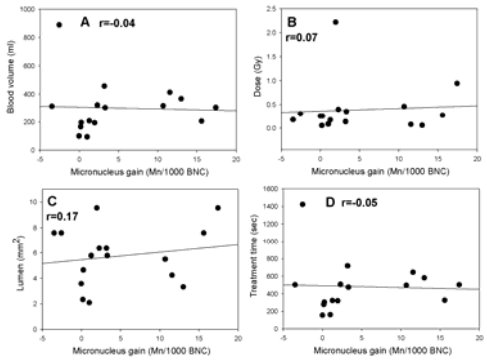
*: difference significant with p<0.05 (Student´s test)
#: difference significant with p<0.05 (chi-square test)



Mean micronucleus frequencies in the groups of patients with restenosis treated with brachytheapy or angioplasty. Error bars: standard deviations.



Correlations between the micronucleus gain observed in lymphocytes of brachytherapy patients and A: the average blood volume exposed, B: the average dose to a single lymphocyte, C: the free lumen of the blood vessel, D: the duration of brachytherapy.



Project that will start at GMT: DNA damage and repair in cells exposed to mixed beams of radiation

Who is exposed to mixed beams of radiation?

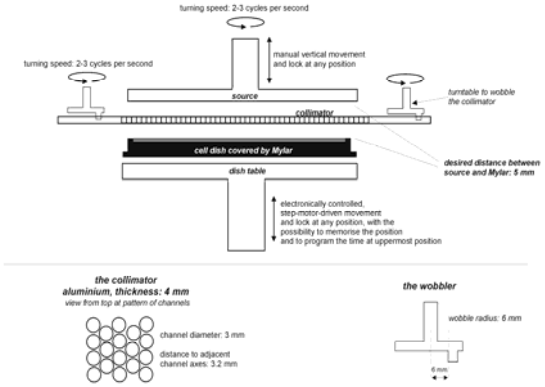
Collaboration with
IE JRC EC, Petten, Netherlands

People living in areas of high natural background radiation

Astronauts

Cancer patients treated by high energy intensity modulated radiotherapy (IMRT)
(γ,n reaction)

Facility for exposure of blood to Am-241 (50 MBq)

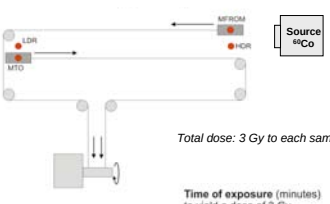


Project that will start at GMT: Impact of a changing dose rate on the cellular effects of ionising radiation

During take off and landing passengers and crew are exposed to a changing dose rate
Is there a difference in the biological effect of increasing or decreasing dose rate?

Preliminary results on Impact of a changing dose rate on the cellular effects of ionising radiation

Scheme of the experimental setup



Total dose: 3 Gy to each sample

Time of exposure (minutes)
to yield a dose of 3 Gy

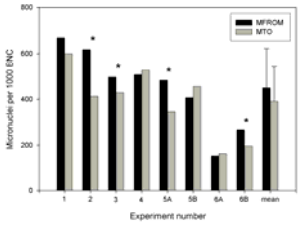
order of exposures	MFROM	MTO	LDR	HDR
	20	20	20	
	18	18	18	
			12	12
				17
Sum:	38	38	50	29

The total dose was split into fractions with a break of about 1 min. This was done for 2 reasons:

1: the source can not be open for longer than 20 min

2: in order to reduce the overall time of the experiment the samples were exposed at the same time. This meant removing some samples from the room as soon as the dose of 3 Gy was reached.

Prelimiary results of the impact of a changing dose rate on the cellular effects of ionising radiation



Micronucleus frequencies in lymphocytes exposed to a dose of 3 Gy in the state of movement to and from a radiation source. MFROM: declining dose rate, MTO: increasing dose rate, BNC: binucleated cells. Numbers indicate independent experiments. In experiments 5 and 6 blood from two donors was exposed. *: difference significant with p<0.05 (chi2 test), bars represent standard deviations. Work done in collaboration with A. Gonzales and E. Azzam, *unpublished*.