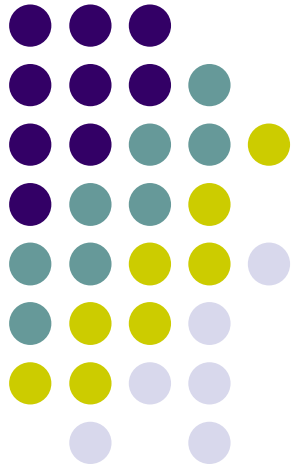
Structural Genomic Damage in Plutonium Workers

N. V. Sotnik, T. V. Azizova, S. V. Osovets

Southern Urals Biophysics Institute, Ozyorsk, Russia



13 International Congress of IRPA

May 13-18, 2012 Glasgow, Scotland

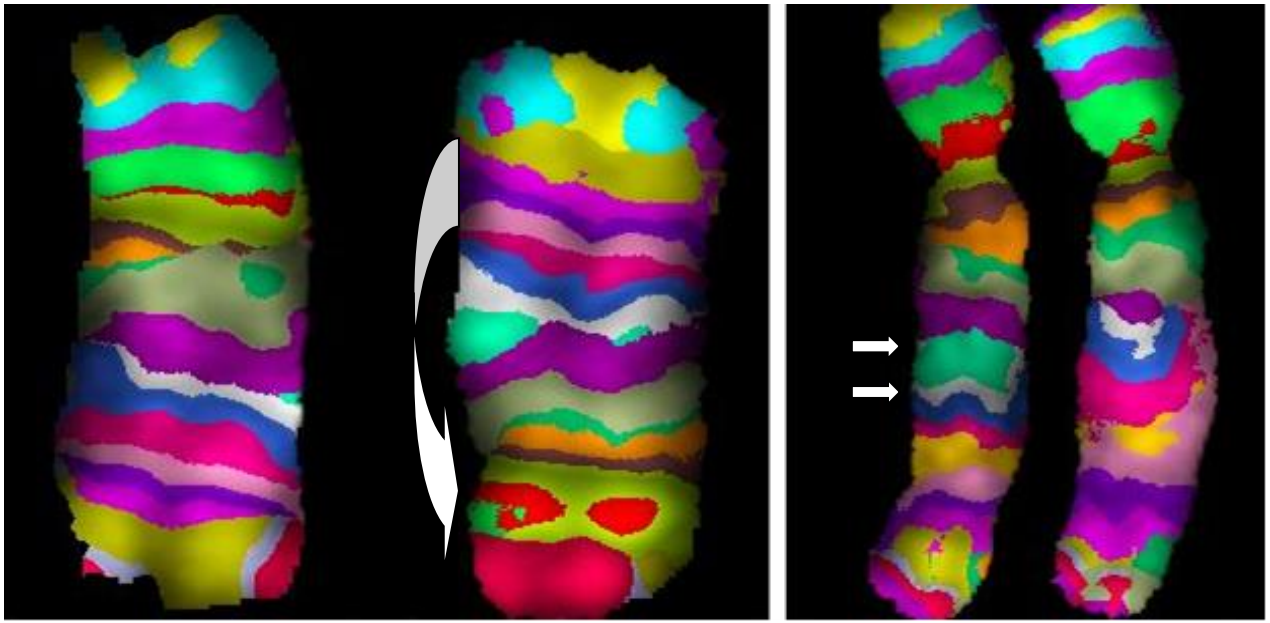
The focus of the study

To estimate the frequency of chromosomal aberrations in the workers of the Mayak Production Association exposed to ionizing radiation

The study population

PA Mayak workers: men	50
women	29
Average age, years	72.1 ± 0.9
Absorbed dose from external γ-exposure to RBM, Gy (average ± SD, Gy)	0.0 – 2.7 (0.86 ± 0.09)
Absorbed dose to RBM from incorporated ^{239}Pu, Gy (average ± SD, Gy)	0.0 – 0.8 (0.12 ± 0.02)

Cytogenetical method



- **multi-color banding FISH (i.e. mBAND) implies paining of a chromosome in multi-color bands in a specific order to detect intra-chromosomal aberrations including pericentric and paracentric inversions**

Statistical method

Linear regression model

$$Y = a + bX,$$

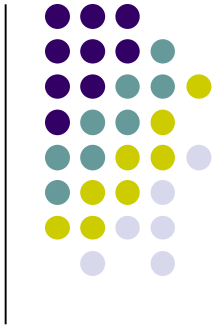
Y is the yield of chromosomal aberrations (per 100 cells);

X is the absorbed dose to the RBM from external (internal) radiation (Gy);

a is the yield of chromosomal aberrations at the “zero” dose;

b is the yield of chromosomal aberrations per dose unit.

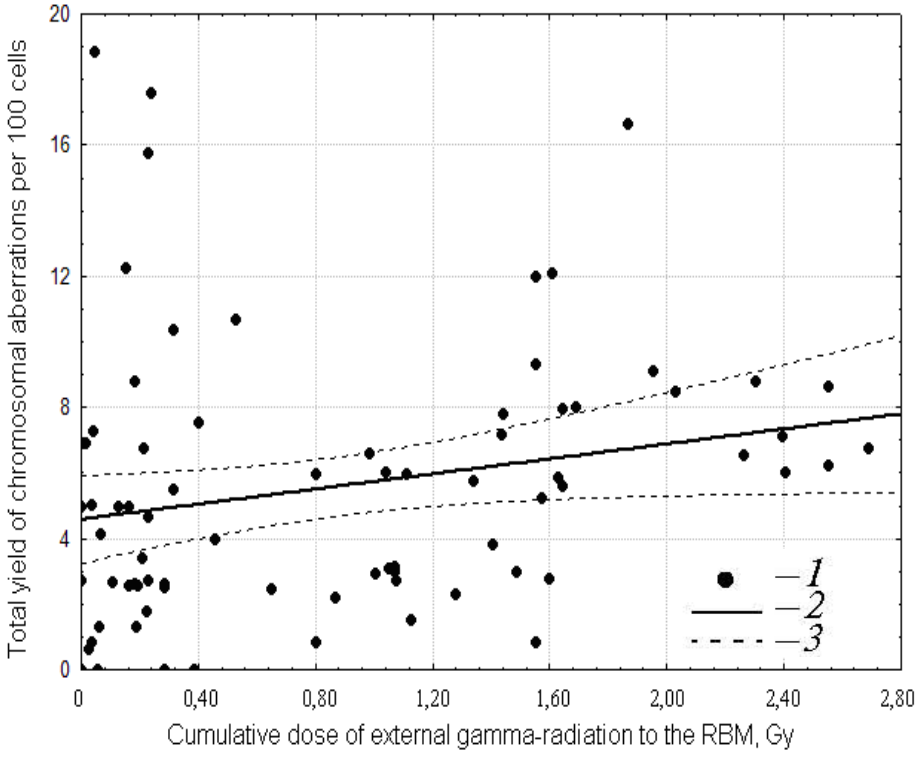
The yield of chromosomal aberrations detected by mBAND

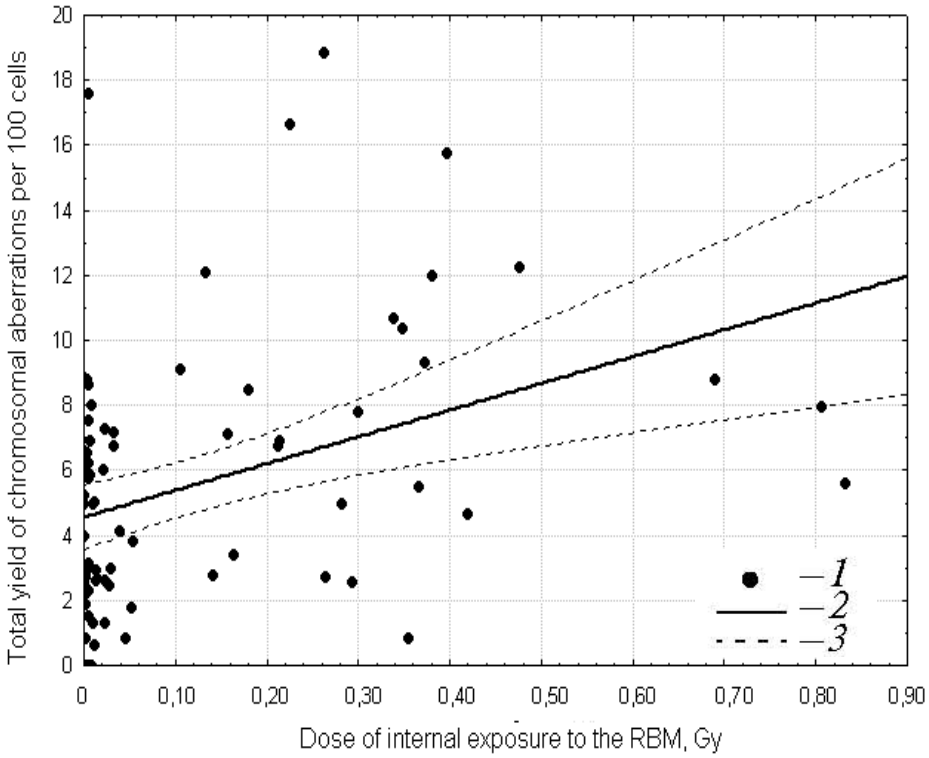


Group	Yield of chromosomal aberrations per 100 cells	
	interchromosomal	***intrachromosomal***
Reactor plant workers	0.53 ± 0.16	0.09 ± 0.05
Plutonium plant workers	1.09 ± 0.30	2.03 ± 0.56*, §
Radiochemical plant workers	0.63 ± 0.16	0.75 ± 0.27

Note: * - statistically significant differences ($p<0.001$) with reactor plant workers;
§ - statistically significant differences ($p<0.05$) with radiochemical plant workers

Dependence of total yield of chromosomal aberrations from cumulative dose of external gamma-radiation and internal alpha-exposure to the RBM



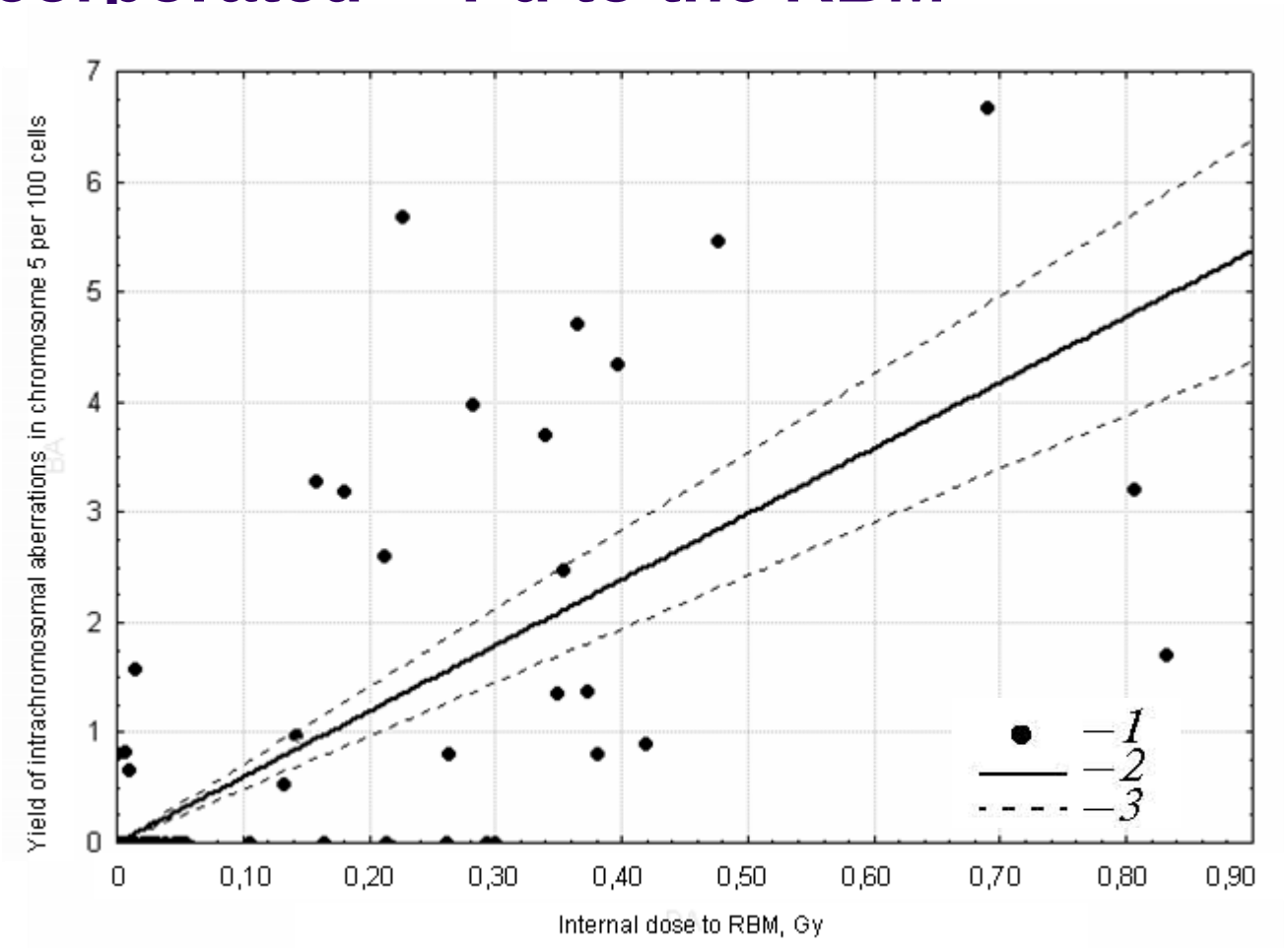


(1) Experimental points

(2) regression line

(3) 95% confidence interval for the linear regression

Dependence of intrachromosomal aberration yield from internal alpha-exposure from incorporated ^{239}Pu to the RBM



(1) Experimental points

(2) regression line

(3) 95% confidence interval for the linear regression

Summary

The present study revealed:

- the yield of intrachromosomal aberrations was statistically significant higher in plutonium plant workers as compared with reactor and radiochemical plant workers;
- the relationship between the total yield of chromosomal aberrations (intra- and interchromosomal ones) and the absorbed dose from external γ-exposure to the RBM and the absorbed dose of internal exposure to the RBM from incorporated ^{239}Pu;

Summary (continue)

- the relationship between the frequency of intrachromosomal aberrations and the absorbed dose of internal exposure to the RBM from incorporated ^{239}Pu.

Acknowledgement

- This work was financially supported by Federal Medical Biological Agency, Russia.