Pryakhin E.A., Urutskoev L.I., Tryapitsina G.A., Akleyev A.V.

Chelyabinsk State University, Chelyabinsk, Russia
RECOM company "Kurchatov institute", Moscow, Russia
Urals Research Center for Radiation Medicine, Chelyabinsk, Russia

Assessment of biological effects of "strange" radiation

The two principal questions brought up in connection with the assessment of the biological effects of “strange” radiation:

1. Is exposure to “strange” radiation safe for the personnel engaged in the studies?
2. Can biological systems serve as detectors of “strange” radiation?

Objective of the study:

Investigation of the biological effects of "strange" radiation

Project tasks :

1. Estimate the primary hematological parameters after exposure of experimental animals to "strange" radiation resulting from explosion of foils in water or aqueous solutions.
2. Study the genotoxic effects of the "strange" radiation.

Experimental conditions:

- Experiments were performed at the RECOM company “Kurchatov Institute”, Moscow.
- The animals used in the experiment were female mice of C57Bl/6 line aged 80 days with body weight 16-18 g.
- Animals were exposured to “strange” radiation resulting from explosion of Ti foils in water or aqueous solutions.
- Explosions were carried out on the 19th (3 explosions in water), 20th (4 explosions in water) and 22nd (3 explosions in 40% glycerin solution) of April, 2004 (explosions ##1373- 1382, respectively).

Schematic presentation of the experiment

Hematological studies

Group	Number of exposure days	Total number of explosions	Number of animals per group
Control	-	-	20
B1	1	3	20
B2	2	7	17
B3	3	10	19

Schematic presentation of the experiment

Estimation of the CFUs after acute gamma irradiation

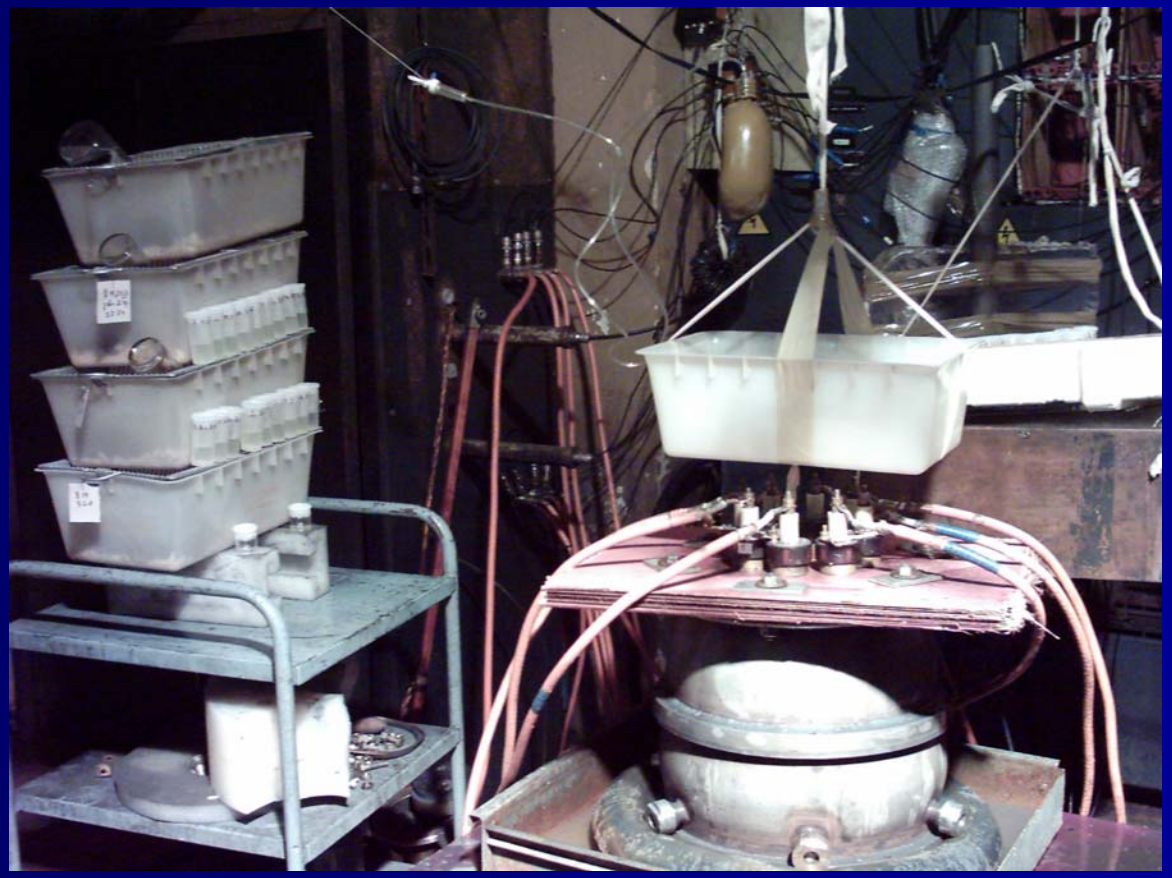
Group	Number of exposure days	Total number of explosions	Number of animals per group
Control + 6 Gy	-	-	20
B1 + 6 Gy	1	3	20
B2 + 6 Gy	2	7	17
B3 + 6 Gy	3	10	20
6 Gy + B3	3	10	20

Schematic presentation of the experiment

Assessment of the genotoxic effects (micronuclei test)

Group	Number of exposure days	Total number of explosions	Number of animals per group
Control	-	-	20
B1	1	3	20
B2	2	7	17
B3	3	10	19
Control + 2 Gy	-	-	10
B3 + 2 Gy	3	10	10

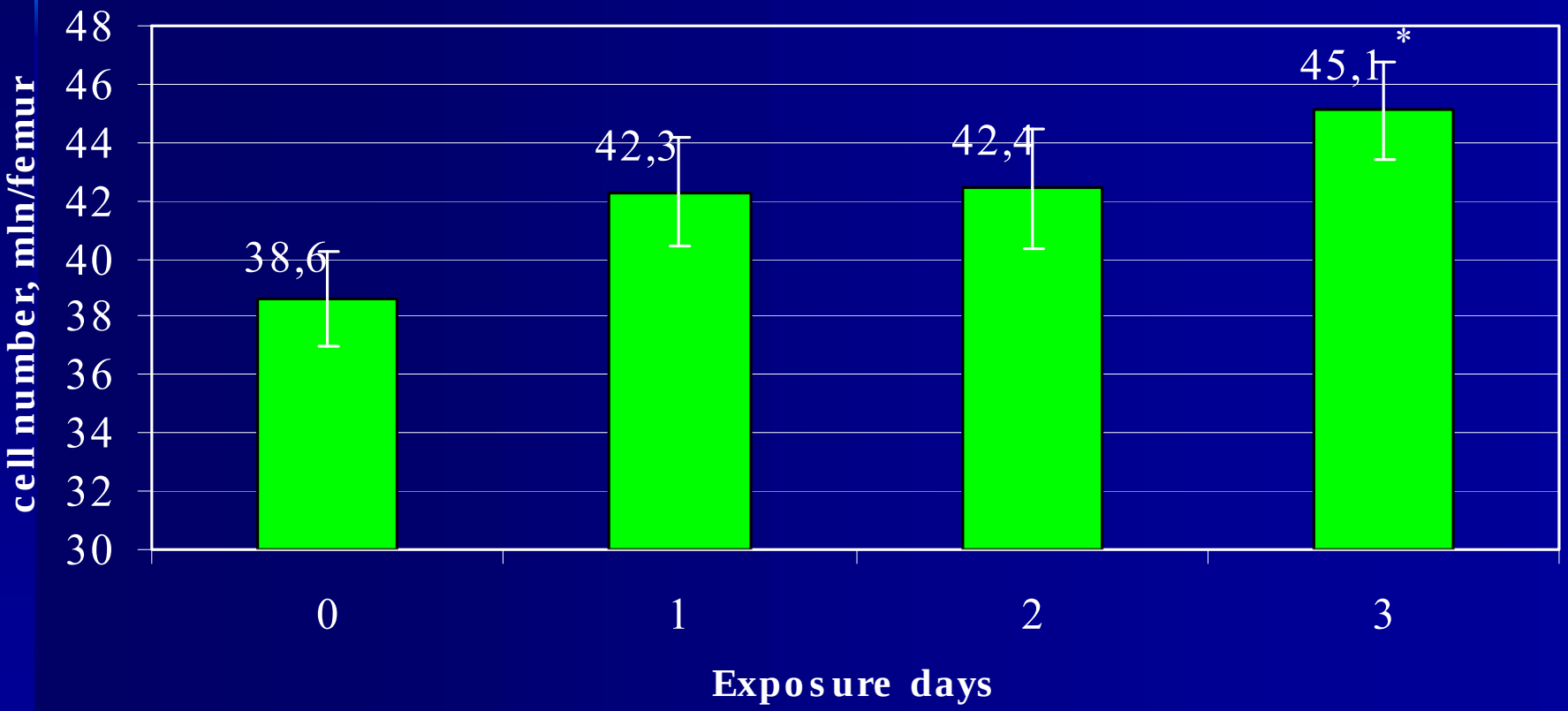
Disposition of animals



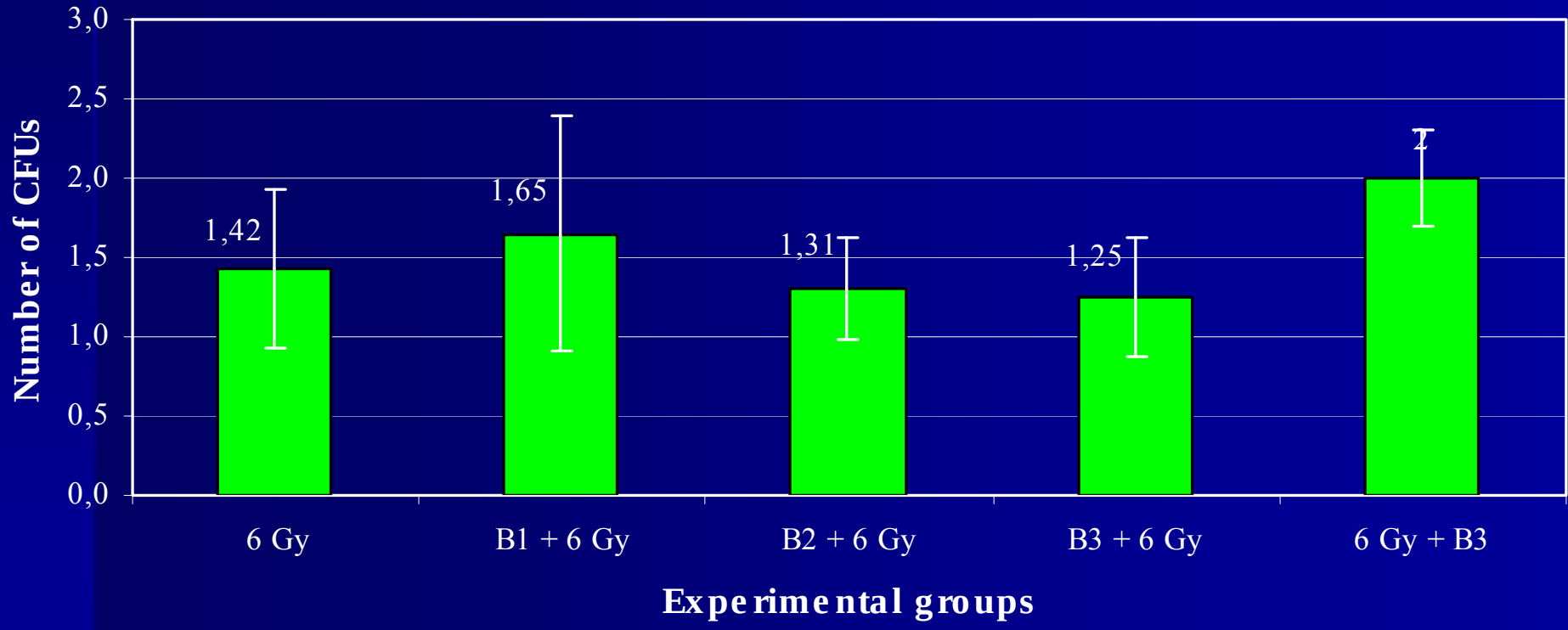
Parameters for assessment of biological effects

- Number of cells in the bone marrow;
- Bone marrow cell composition;
- Rates of erythrocytes with the different degree of maturation in the bone marrow;
- Evaluation of bone marrow CFUs population;
- Rates of micronuclei in bone marrow erythrocytes;
- Number of leucocytes in the peripheral blood;
- Peripheral blood cell composition.

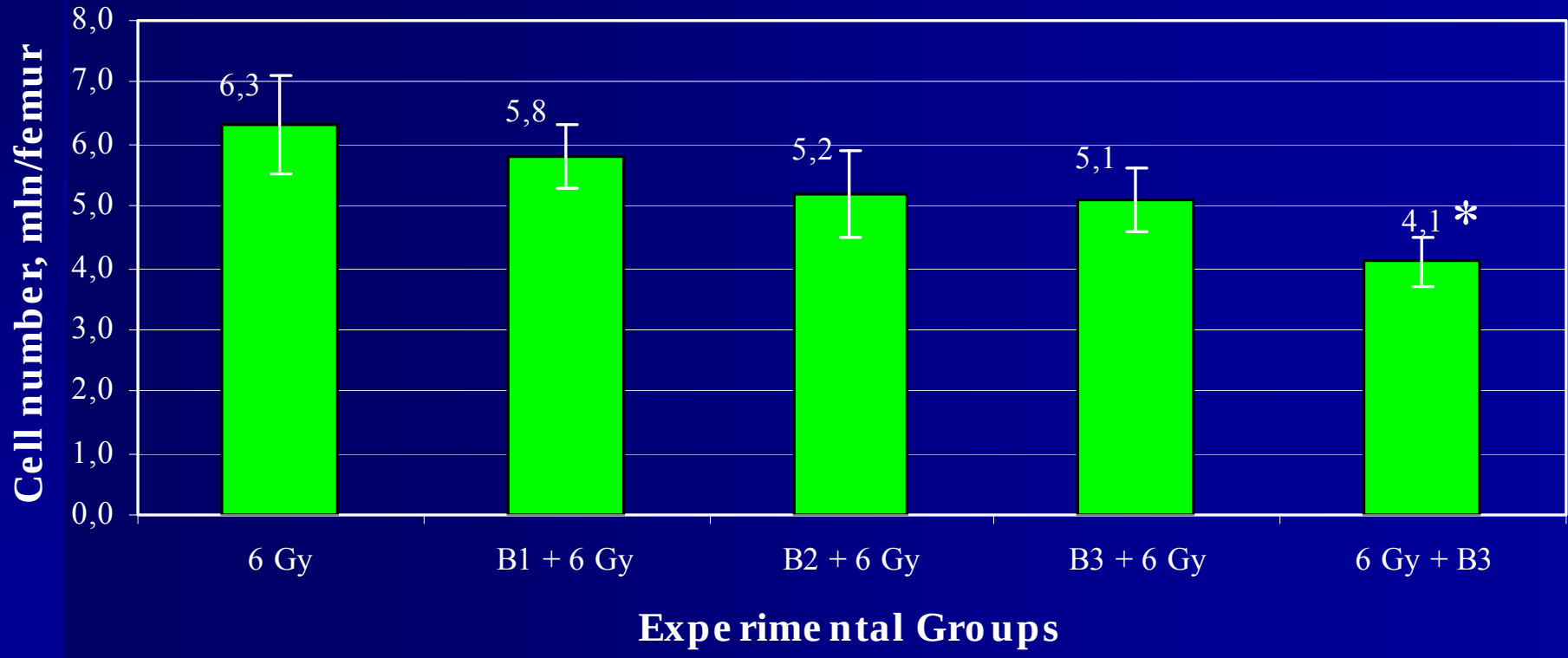
Relationship between exposure time and the number of bone marrow cells



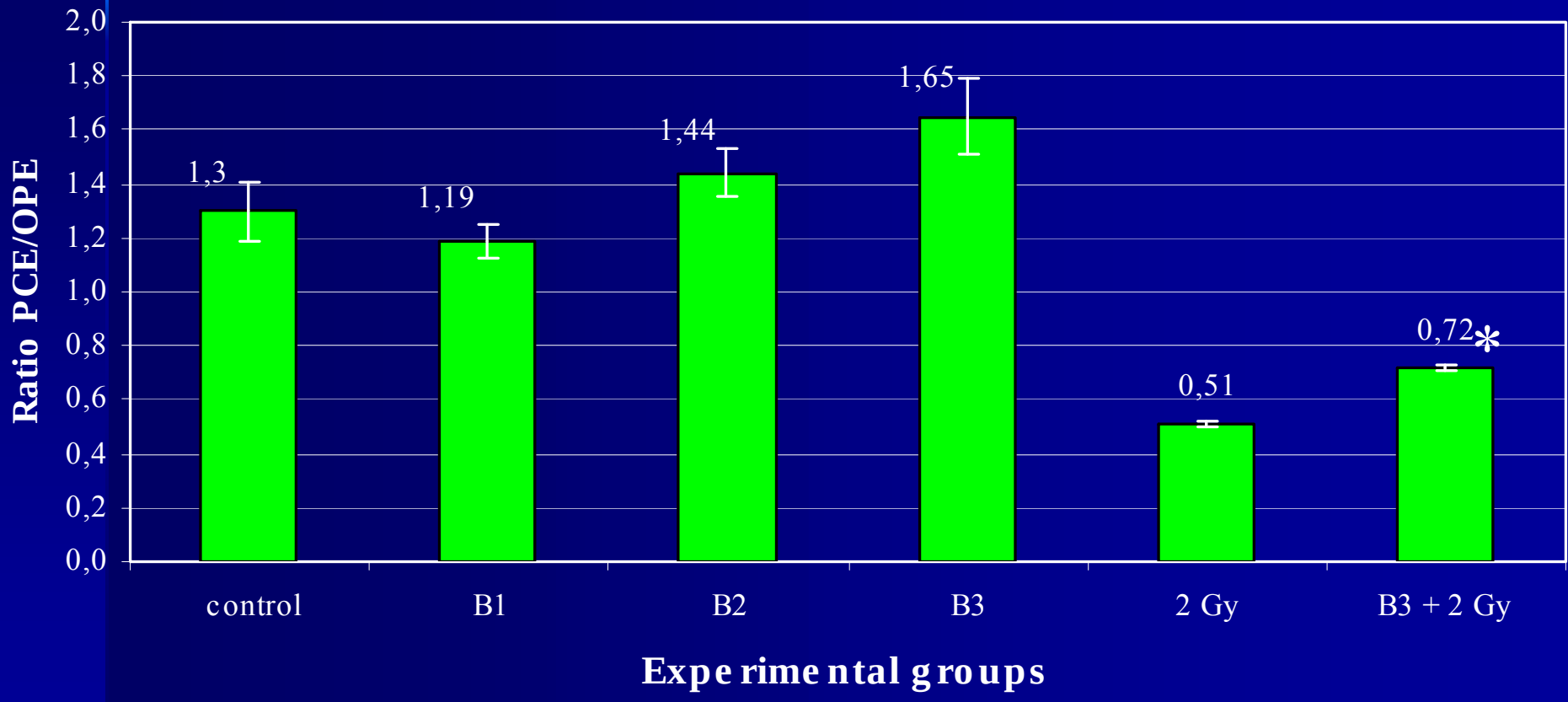
Number of CFUs in different experimental groups after gamma-irradiation of mice at a dose of 6 Gy



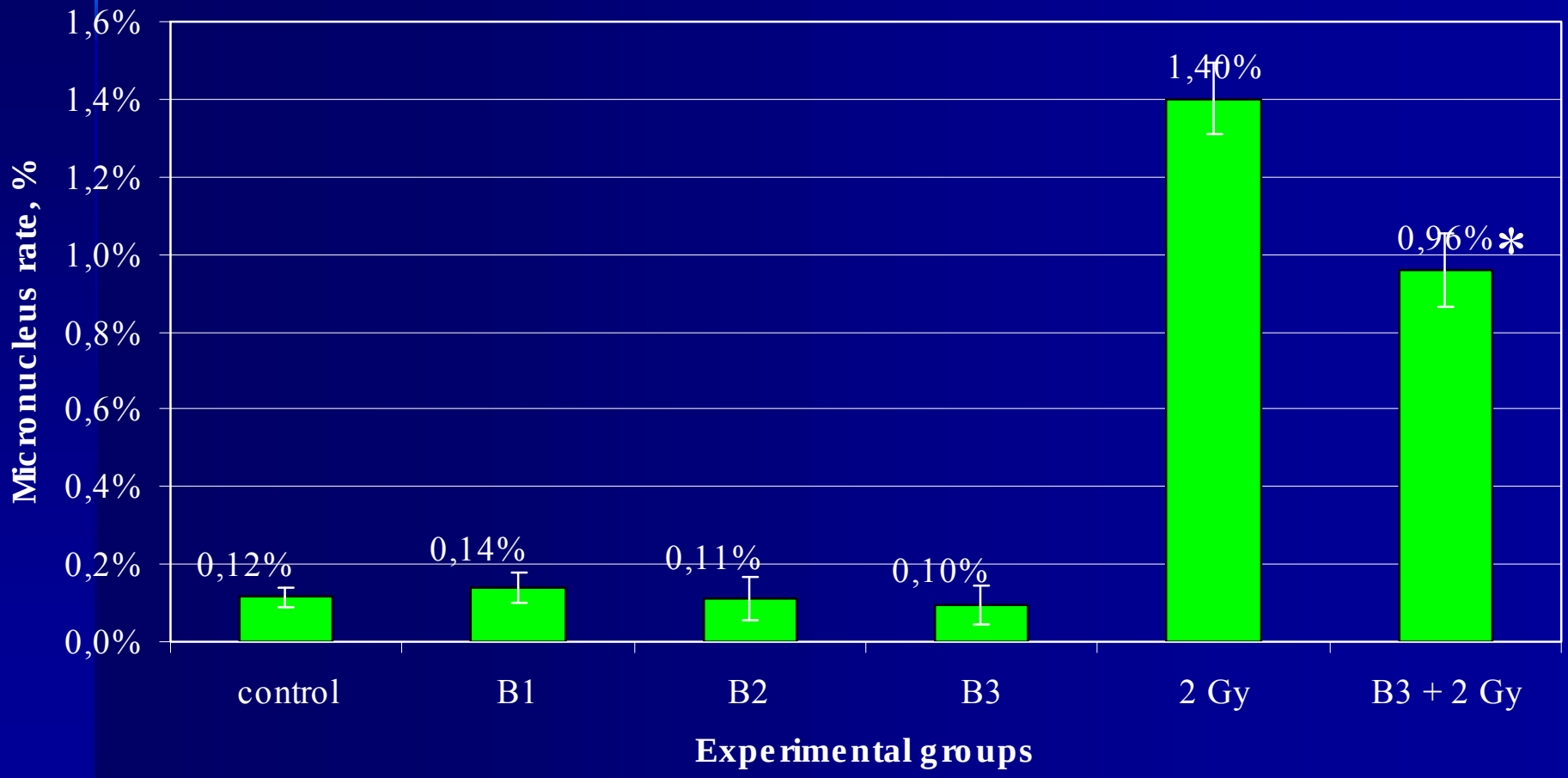
Number of bone marrow cells in different experimental groups after gamma-irradiation of mice at a dose of 6 Gy



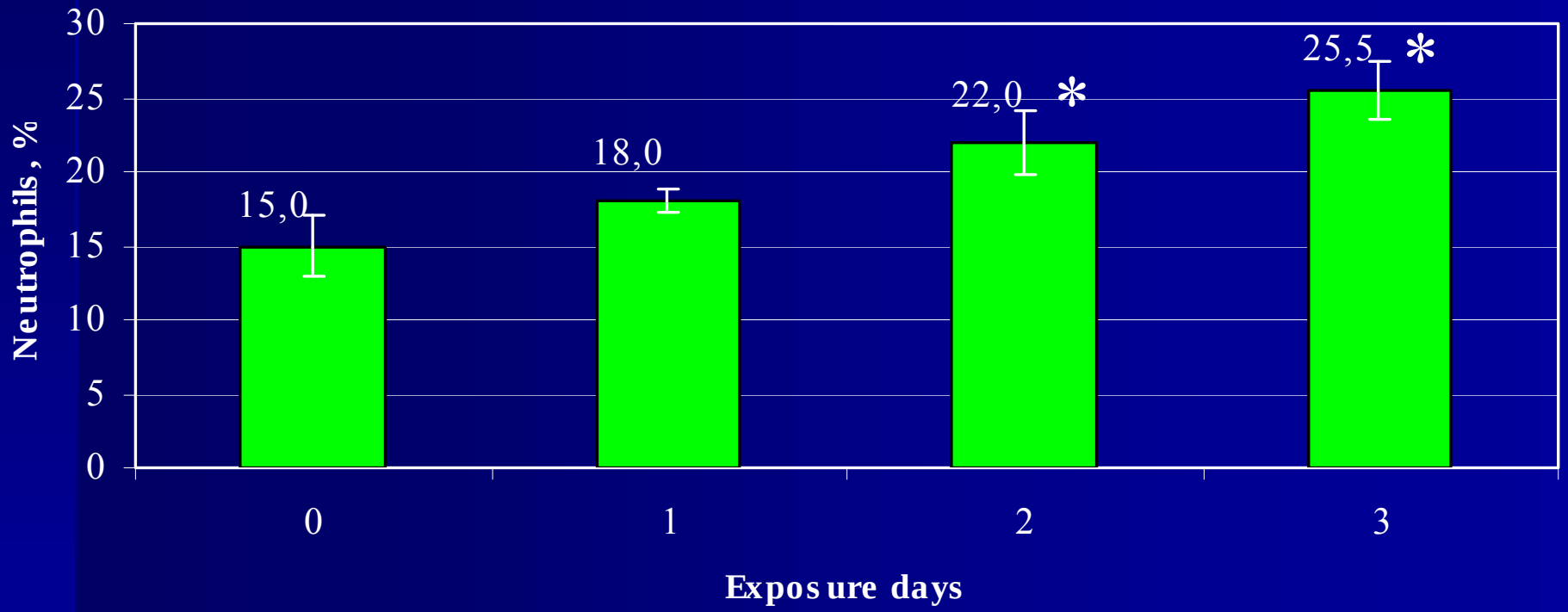
Ratio polychromatophil-to-oxiphil bone marrow erythrocytes in different experimental groups



Rates of micronuclei in polychromatophile bone marrow erythrocytes for different experimental groups



Relationship between the rates of peripheral blood neutrophils and exposure time



Conclusions

1. "Strange" radiation resulting from explosion of Ti foils in water and aqueous solutions has a capacity for producing biological effects.
2. Biological effect of "strange" radiation is manifested by increase in the number of nucleated cells in the bone marrow.
3. "strange" radiation leads to an increase in dividing cells in bone marrow.
4. "strange" radiation resulting from 10 explosions carried out within 3 days after the gamma-radiation (6 Gy) leads to a decrease in bone marrow repopulation.
5. Assessment of micronuclei rate in the bone marrow erythrocytes did not reveal any genotoxic effect of "strange" radiation.
6. Exposure of mice to "strange" radiation leads to 1.5-fold decrease in genotoxic effect resulting from additional gamma-irradiation (2 Gy). Such reaction may be described as an adaptive response.
7. Exposure to "strange" radiation can bring about an increase in the proportion of neutrophils in the peripheral blood of experimental animals.
8. It can be suggested by the results of the test exposures that "strange" radiation can affect human health.
9. It has been shown by these preliminary studies that in order to gain an insight into the biological effects of "strange" radiation further investigation would be necessary.