Chromosome analysis for calibration curves creation for potential retrospective dose estimation

Manned space missions and ionizing radiation application recently increased in number and duration, thus it becomes important to estimate the biological risks encountered by people deal with radiation. In order to predict the consequences of the exposure it is necessary to estimate the dose. In addition to the measurements realized by physical methods, it becomes essential to estimate biologically effective doses. Biological dosimetry of radiation exposures becomes more important if the possibility to calculate or measure the dose by physical methods does not exist.

The most specific and the most sensitive technique of the present biological dosimetry based on estimating the frequency of chromosomal aberrations in peripheral blood lymphocytes of the exposed person.

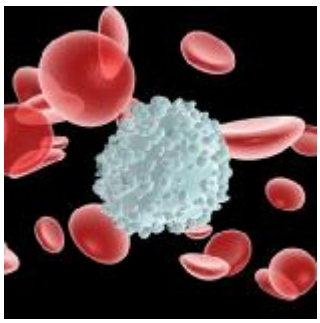
Numerous studies on animals and human have demonstrated the close correspondence between aberrations induced in peripheral blood lymphocytes *in vivo* and *in vitro*. This fact allows defining the radiation dose with the help of *in vitro* calibration curves. These curves are created by irradiation with several doses blood samples, collected from several control donors.

The dicentric assay technique remains the gold standard in accident-biodosimetry and defining dose assessment of low LET radiation like gamma and X rays (IAEA, 2001).

It is well known that irradiation of mammalian cells by high doses of radiation or by radiation with high LET causes the cell cycle delay, thus the level of chromosome aberration obtained by standard metaphase method underestimates. The technique of chemically premature chromosome condensation (PCC) induced by calyculin A allows to remove the delay and thus has been recommended as easy biodosimetric technique for acute dose estimation in case of accidental exposure to high LET and high doses of low LET radiations.

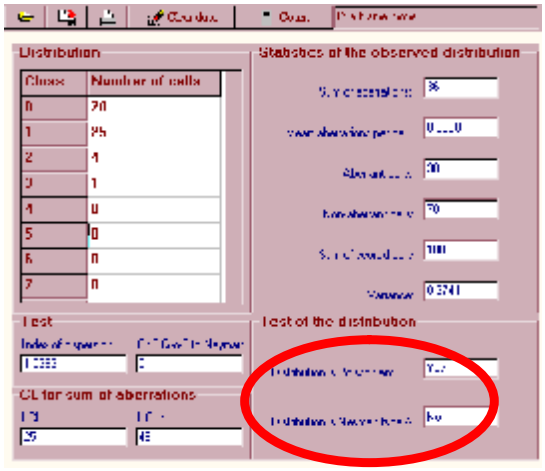
During the practice students will become familiar with:

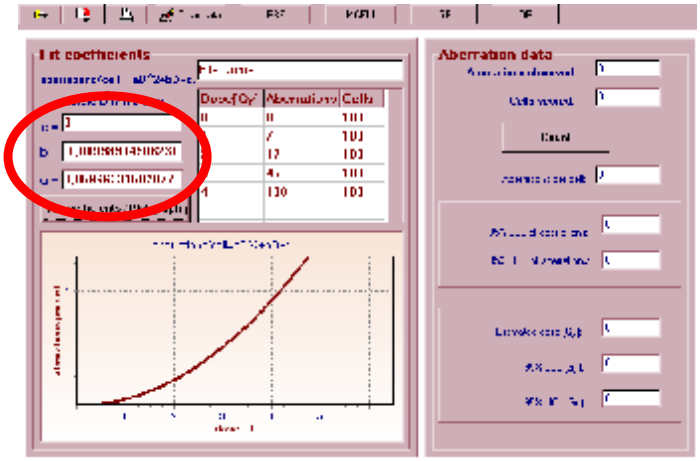
- human peripheral blood lymphocytes keeping *in vitro*;
- fixation and slide preparation of lymphocytes;
- chromosome aberration analysis by metaphase and PCC methods;
- the results processing with CABAS and NETA software.



An example of metaphase cell

An example of PCC cell





Recommended:

- IAEA (2001) Cytogenetic analysis for radiation dose assessment. A manual International Atomic Energy Agency, Vienna

- Gotoh E. et al. (2005) Simple biodosimetry method for use in cases of high-dose radiation exposure that scores the chromosome number of Giemsa-stained drug-induced prematurely condensed chromosomes (PCC). Int J Radiat Biol. Jan 81(1):33-40

- Deperas J. et. al. (2007) CABAS - a freely available PC program for fitting calibration curves in chromosome aberration dosimeter. Radiat Prot Dosimetry 124:115-123

- Durante M. et. al. (1998) A simple method for simultaneous interphase-metaphase chromosome analysis in biodosimetry. Int. J. Radiat. Biol 74:457–462

- Wojcik A. et. al. (2004) Cytogenetic damage in lymphocytes for the purpose of dose reconstruction: a review of 3 recent radiation accidents. Cytogenet Genome Res 104:200-205

- http://www.iaea.org/

- http://www.ujk.edu.pl/ibiol/neta/

- http://www.ujk.edu.pl/ibiol/cabas/

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