ESRF	**Experiment title:** *Photon Activation Therapy trial on cells cultures with intranuclear stable iodine or platinum: dose enhancement and DNA damages measurement produced by Auger effect induced by monochromatic photons of synchrotron radiation.*	**Experiment number**: LS-1392
Beamline: ID17	**Date of experiment**: from: *10/11/1999 to 13/11/1999*	**Date of report**: 01/03/2000
Shifts:	**Local contact(s)**: Le Duc Géraldine	*Received at ESRF:*

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Report:

Actual radiotherapy efficiency lies on three main principles : 1) Anatomical restriction of irradiation; 2) Dose fractionnement for small responses differences between healthy and tumoral tissues enhancement; 3) treatment of tumors with higher radiosensitivity than surrounding safe tissues. Concomittant associations between radiotherapy and chemotherapy is commonly used for improvement of the two last points mentionned above. For instance, the well-known chemotherapy compound, named as *Cisplatin*, affords tumoral radiosensitizing properties. Nevertheless there is no real evidence that this DNA alkylating agent presents some benefit in association with classical radiotherapy in the particular case of cerebral tumor treatment. If we could use the fact that this drug is covalently bound to DNA from tumoral cells, to enhance dose deposition in its proximity, then we would be able to enhance radiation interaction effect inside tumoral tissues only.

Moreover platinum, as high-Z compound, is all the more interesting as the wavelength necessary to resonantly create a K-shell vacancy in its electronical configuration is 78 keV.

This point is particulary interessant, because it means that X-Rays would be penetrating enough to be used for small depth tumor treatment.

During this second set of experiments at ESRF, two series of 56 cell culture flasks, treated or not three days before with 0,1 μM of cis-diaminedichloroplatinum (II), were maintained into growing conditions until expected irradiation day. Just before the beginning of irradiation, flasks were brought at ESRF and stored into incubators, where a controlled humidified atmosphere (37 °C; 5% CO_2) allows minimum disruption of our living cells. Dosimetry measurements were performed after beam alignement (delay of 24 hours due to many technical problems on the medical beamline). With the tomography monochromator, high-energy monoenergetic beam (like 78 keV) is reachable but photonic fluence, and consequently the doserate, is very low. For irradiation, 8 samples at once were placed on the special support, previously used. For vertical scanning of these samples, the angiography chair positioning system that was used during our last experiments was replaced by two superposed vertical motion motors. This new setup was once again clearly non-adapted and should be improved for next runs. One of the motors was overloaded by the another one, and didn't withstand few thousands of 40 cm-height translations without overheating.

In spite of these average experimental conditions, all our samples were properly irradiated during this run. Our 112 cell culture flasks were brought back to our cell biology laboratory for low-density subculture. Each flask was trypsined and a known number of cells was put into three Petri's dishes, for colony forming assay. About two weeks after, 300 Petri's containing cell colonies have been colored with Cristal Violet. Colonies' count has been made manually. Survival curves obtained shows that the pre-treated cells with cisplatinum seem to be more sensitized when irradiated above than below platinum K-edge. These preliminary results are promising although experimental conditions have not been optimized on the point of view of pharmacology yet. Feasibility of irradiation and biology procedures have been proved during this experiment. Next steps will be: 1/ to test different experimental conditions, in particular to increase the cisplatinum cell loading;
2/ to study the type of cellular damages that are enhanced by platinum photo-activation;
3/ to analyze by synchrotron light micro-imaging load and sub-cellular distribution of platinum (ID22 proposal);
4/ to optimize survival analysis method by computer assisted image processing.