Indirect Radiation Therapy of Cancer with Synchrotron Radiation at the K-Edges of Heavy Metal Complexes and Target-Nanoparticles

Thomas Nawroth[1a], Heinz Decker[1b], Christian Meesters[1b], Bruno Pairet[1b], Monika Rusp[2], Meritxell Costa Torres[3], Stéphanie Corde[4], Peter Boesecke[5a], Géraldine Le Duc[5b], Alberto Bravin[5c]

[1]Gutenberg-Universität: a) Biochemistry, Becherweg 30, b) Molecular Biophysics, Welder-Weg 23; D-55099 Mainz, Germany – [2]Technical University Munich TUM, Biophysics E22, Physics Department, James-Franck-Str., D-85747 Garching, Germany – [3]Biophysics Unit, Biochemistry and Molecular Biology Department, Universidad Autónoma de Barcelona, E-08193 Ballaterra, Spain – [4]Dep. Hemato-Cancerologie-Radiotherapie, CHRU clinics, B.M. 217X, F-38043 Grenoble Cedex9, France – [5]ESRF European Synchrotron Radiation Facility: a) ASAXS beamline ID01, b) BioMedical Facility BMF, c) Medical beamline ID17; BP220, F-38043 Grenoble, France

Indirect radiation therapy of cancer IRT inactivates tumors cells by secondary products evolving from an incorporated target upon specific absorption of therapeutic radiation, which is depicted as photon activation therapy PAT by K-edge target absorption of synchrotron radiation (fig.1). We apply biocompatible heavy metal complexes of Lanthanides, e.g. Gadolinium- to Lutetium-DTPA in target-nanoparticles and in key-formulations breaking the blood-brain barrier (BBB). The novel cancer therapy is optimised towards minmal body dose Q_b (demage) at maximal healing dose Q_t, specifically absorbed at the local target material. With our materials using the heaviest Lanthanide Lutetium (E_K = 63.31 keV) the relative therapeutic absorption $A_tb = Q_t/Q_b$ can be up to 10 %, as calculated for an 1 cm target area covering a brain tumor in a human head (12 cm path); with Gadolinium an effect of A_tb=6.3 % is possible at E_K = 50.24 keV. This lead to the imaging- therapy postulate for indirect radiation therapy: „An effective (adjuvant) cancer therapy target should be visible by in vivo contrast imaging (therapeutic imaging).“ In animal tests with rats the imaging-therapy postulate was successfully verified. First therapy trials with rats bearing brain tumors are running.

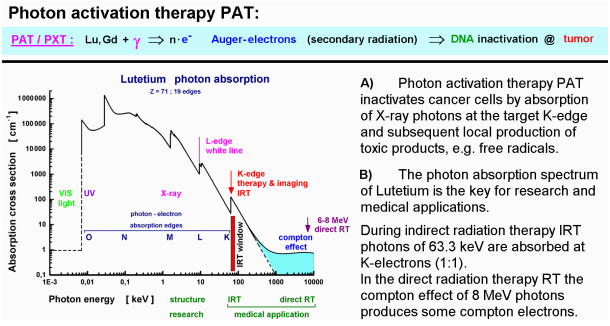

Abb. 1: Principles of indirect radiation therapy IRT, i.e. photon activation therapy PAT, and direct radiation therapy RT with an incorporated Lutetium target.

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