Program of the new International Open Laboratory at NIRS *

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The National Institute for Radiological Sciences (NIRS) is the leading Japanese research institute in radiation research. It is well known worldwide especially for the heavy-ion therapy, which started at the Heavy Ion Medical Accelerator (HIMAC) (Fig. 1) in 1994. Since then, over 5,000 patients have been treated with high-energy C-ions for many different results, and generally with excellent results [1]. For comparison, 440 patients were treated at GSI in the pilot project 1997-2208 [2].

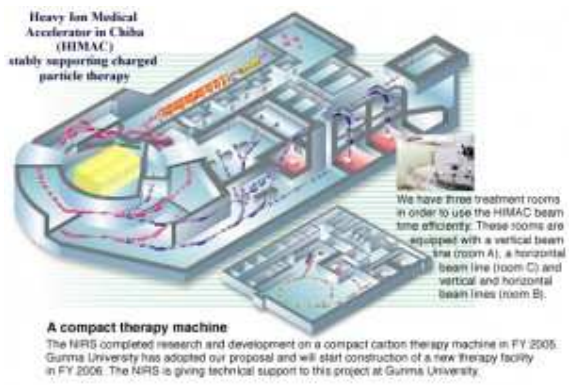

Figure 1: The HIMAC accelerator in Chiba (Japan)

NIRS has a long tradition of collaboration with research groups in Asia, Europe, and USA. To enforce these links, the International Open Laboratory (IOL) program was launched in 2008, where foreign scientists are invited to NIRS to perform experiments together with local groups. The program includes beamtime availability at HIMAC, and a financial support of approximately 10 M¥ in 3 years.

A new IOL has been approved in 2010 which will be led by GSI in collaboration with the Charged particle research centre at NIRS. The new IOL is called "particle Beam Quality Research Unit", and its main activity will be the dependence of human tumour radiosensitivity from the genetic background. In fact, it is known that several genetic mutations confers resistance to cancers, for instance those in apoptotic pathway, controlled by the p53 gene. As roughly 50% of the human cancers carry mutations in the p53 gene, we hypothesize that carbon ions may be able to overcome the genetic sensitivity of this cancers. If correct, these results could greatly expand the number of patients that can potentially benefit from heavy-ion therapy.

To accomplish this task, we plan to exploit the large database of tumors genetically screened developed at NIRS within the RadGenomics Project, led by Dr. Imai [3]. We will also collaborate with Dr. Yamada for the in vivo assay of the tumorigenicity of the cell surviving X-rays or C-ion exposure.

The IOL will also be a unique opportunity to reinforce the links between GSI and NIRS in other topics, such as treatment planning models, where already several collaborative studies have been performed [4], and treatment of moving targets with scanned beams, a field where GSI has a large and consolidated experience [5] and has to be carefully studied also at NIRS in view of the new spot-scanning system recently installed I the new patient irradiation room at NIRS [6].

The activities of the new IOL will start in April 2011.

References

[1] Okada T, Kamada T, Tsuji H, Mizoe JE, Baba M, Kato S, Yamada S, Sugahara S, Yasuda S, Yamamoto N, Imai R, Hasegawa A, Imada H, Kiyohara H, Jingu K, Shinoto M, Tsujii H. Carbon ion radiotherapy: clinical experiences at National Institute of Radiological Science (NIRS). J Radiat Res 2010;51:355-64.

[2] Kraft G. Ion beam therapy in Europe. AIP Conf. Proc. 2009; 1099: 429-34-

[3] Michikawa Y, Suga T, Ishikawa A, Hayashi H, Oka A, Inoko H, Iwakawa M, Imai T. Genome wide screen identifies microsatellite markers associated with acute adverse effects following radiotherapy in cancer patients. BMC Med Genet. 2010;11:123.

[4] Kase Y, Kanai T, Matsufuji N, Furusawa Y, Elsässer T, Scholz M. Biophysical calculation of cell survival probabilities using amorphous track structure models for heavy-ion irradiation. Phys Med Biol. 2008;53:37-59.

[5] Bert C, Gemmel A, Saito N, Chaudhri N, Schardt D, Durante M, Kraft G, Rietzel E. Dosimetric precision of an ion beam tracking system. Radiat Oncol. 2010;5:61.

[6] Furukawa T, Inaniwa T, Sato S, Shirai T, Mori S, Takeshita E, Mizushima K, Himukai T, Noda K. Moving target irradiation with fast rescanning and gating in particle therapy. Med Phys. 2010 ;37:4874-9.

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