Biologically Optimized Radiation Therapy

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Foreword

As our knowledge about the molecular biology of cancer is rapidly improving we continuously need better tools to improve diagnostic imaging and treatment methods for cancer, one of our major life threatening diseases. Today a Center of Excellence for advanced radiation therapy should be centered on multiple unique developments that will considerably improve our ability to cure cancer patients and maximize their quality of life.

The high sensitivity, high resolution and ultra wide field of view of advanced PET-CT, MRSI and Stereoscopic Phase Contrast tumor imaging methods will be unique for accurate therapy planning and the early detection of tumor spread. Moreover, the resultant initial images of tumor spread could be the base for treatment response monitoring during the early phase of therapy. Primarily through PET-CT imaging it is possible then to visualize the tumor responsiveness and verify that the first delivered treatments had the planned effect and would allow accurate 4 dimensional in vivo predictive assay and biologically based adaptive therapy optimization. To maximize cure and the therapeutic response of the tumor and minimize eventual adverse normal tissue reactions Intensity and radiation Quality modulated light ions and high-energy photons and electrons are the ultimate therapeutic modalities. They can deliver high densities of severe DNA lesions in genetically instable tumor cells and generally only induce a low density of easily repairable lesions in normal tissues.

The past 20 years of significant improvements of treatment results with IMRT and Light Ion therapy not least at NIRS in Chiba Japan makes it now really important to bring these new tools into clinical use. Since the new diagnostic and therapeutic methods both potentially have mm resolution, new proposed Comprehensive Cancer Centers may introduce a quantum leap in our ability to treat and also cure advanced malignant tumors. As important as the new imaging and therapeutic modalities, are the research and development of new effective treatment methods, and to further develop our knowledge in molecular radiation biology of cancer, to stimulate the

optimal interaction between fundamental biology, biomedical physics and medical care.

It is very important that such centers will be established as soon as possible to make full use of the fast developments in molecular genomics and proteomics and to make the treatments clinically available to the benefit of our cancer patients. This is one of few areas where a substantial investment in new Imaging and Therapeutic methods is cost effective and rapidly bringing improved treatment results and quality of life and actually reducing the expenditure into our medical care system.

Anders Brahme

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