



Singapore Journal of
Scientific Research

ISSN: 2010-006x

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Samples of Vital Human Tumor Tissue Irradiated With Ions for the First Time

Cancer treatment with ion beams developed at GSI is characterized by an excellent cure rate and only minor side effects. The therapy has been routinely in use for a little over one year. The effectiveness of the ion beams not only depends on the tumor type, but also on the genetic disposition and the personal circumstances of the individual patient.

For the first time, scientists at GSI Helmholtzzentrum für Schwerionenforschung have irradiated samples of vital human tumor tissue in the scope of their systematical and fundamental research. Their long-term goal is to enhance the already highly effective ion beam therapy in a way that allows the optimization of the irradiation dose based on the specific tumor of the individual patient. Such a treatment would constitute a novel approach, as radiation treatment so far only considered the type and position of the tumor.

This research is only possible because the University of Frankfurt was able to produce samples of specific human tumors for the first time. The patient-derived tumor tissue is prepared in a way that keeps the tissue sample vital for several weeks. The fact that these samples are consistent with their natural environment allows the scientists to observe the effects of the radiation that occur in the treatment of patients. One of the points the researchers are examining is the so-called "bystander effect" -- the effect that the irradiated cells have on their neighboring cells. Previous tests on artificial cell samples and animal experiments were very limited in this respect.

This cancer therapy developed at GSI has already proven highly effective, with very few side effects. "However, every tumor reacts differently to irradiation: some are more sensitive, stop growing or perish, others are more resistant and remain unaffected by the therapy. The effectiveness of the therapy varies from patient to patient," says Professor Marco Durante, head of the biophysics department at GSI Helmholtzzentrum. "The irradiation and subsequent analysis

of a tissue sample taken from the patient allows us to find out about the tumor's characteristics. And based on this knowledge, the attending physician can optimize the tumor therapy for the individual patient."

Human tissue samples are typically obtained during surgery. A new method now makes it possible to keep those tissue samples vital in the laboratory over several weeks. "These so-called tissue slice cultures are used as a model system for biological studies, because they allow us to look beyond the events that occur in a single cell and help us study the tumor cells in their natural environment surrounded by other cells," explains Professor Ingo Bechmann, who helped develop this new system at Charité in Berlin and Frankfurt University and who now holds a Professorship at Leipzig University. Dr. Kosta Schopow, the Frankfurt-based Physician and Curator of the Senckenberg Foundation, had the idea of using tissue slice cultures for the research at GSI.

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