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Generation and characterization of radiation in biomedical applications

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INTRODUCTION

For more than a hundred years, photon radiation has proved to be an invaluable tool in bio-medical uses from imaging to clinical treatments. While extremely helpful, it has also been observed that radiation can also have long term negative side effects, often unseen until years later. With advances in bio-engineering and atomic physics, as well as advances in observational devices, this research will look more closely at the relationship between photon radiation and cellular structure at the atomic level.

METHODS & MATERIALS

Populations of cells ranging from 3T3 fibroblast to cancer cells are grown in a T75 flask and incubated in media that supplies nutrients for the cells until passaging is necessary. The cells are checked daily and passaged about every four days so that they grow healthy and properly in preparation to be irradiated. The Clemson University Electron Beam Ion Trap (CU-EBIT) will be used as a source for ions which are then used to create monochromatic x-rays that will be used to irradiate the prepared cell cultures. The CU-EBIT is the most advanced of only two ion traps/sources in the entire country. Until now, it has only been used for non-biomaterial research.

PREVIOUS RESEARCH

Articular cartilage was exposed to x-ray radiation at different doses to observe how it affects physical and mechanical properties. Cartilage samples were exposed to various dose levels at 2, 5 and 10 gray (Gy). The most cartilage damage and cell death was observed at 10Gy. The 2Gy sample didn’t show cell death the but the dose was still enough to drop the modulus of tissue by more than a factor of 2.

GOALS

To grow cell samples on various materials in good health and prepare them to be irradiated and observe any effects caused by the radiation. To experimentally test the CU-EBIT’s ability to create monochromatic x-rays. To observe and collect data that will help to better understand the effects of radiation on cellular and molecular structures at the atomic level. That this research will one day improve the safety and effectiveness of all imaging and therapy devices that employ electromagnetic radiation.

REFERENCES AND ACKNOWLEDGEMENTS

http://www.pivot.net/~jpierce/nanotechnology.htm
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