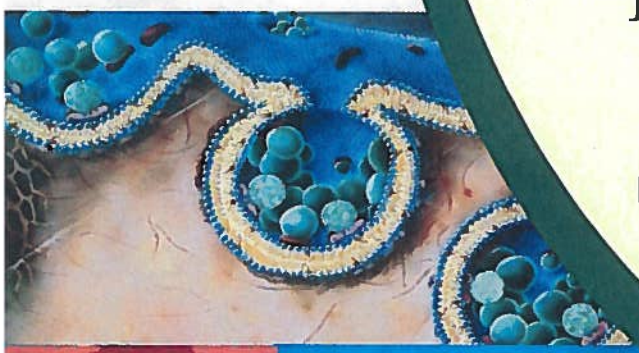

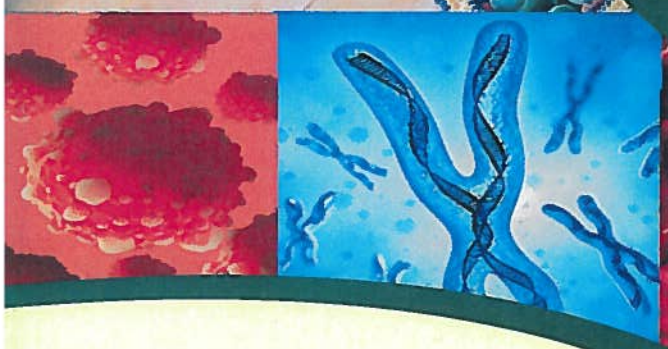

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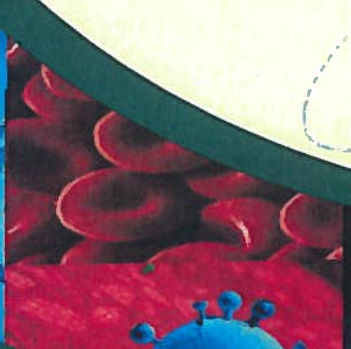

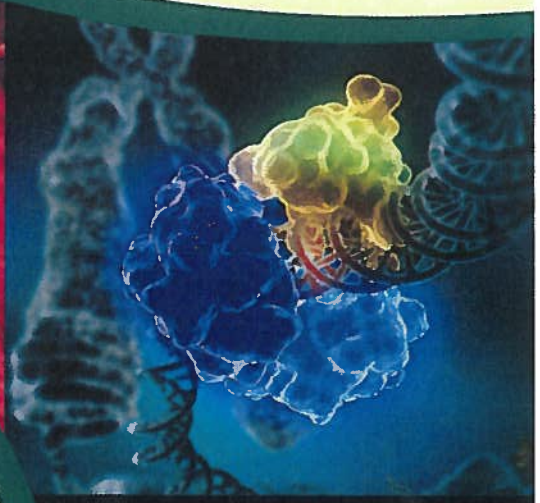

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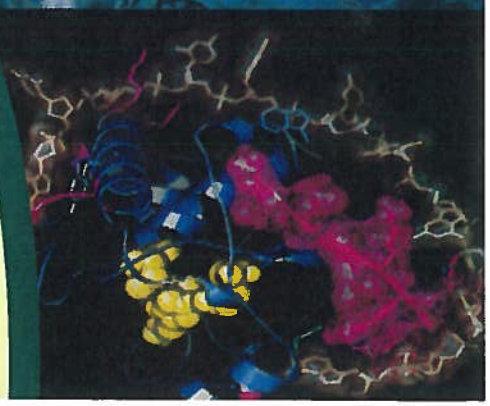

DEPARTMENT OF BIOCHEMISTRY

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X-RAY ABSORPTION BY HEAVY ELEMENT COMPOUNDS AND APPLICATIONS IN RADIATION THERAPY

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We will describe the atomic-molecular-bio physics of X-ray irradiation of high-Z heavy-element nanomaterials as radio sensitizing agents in cancer therapy. High energy x-rays interact mainly with the heavy element in the compound through inner shell electrons for photo-absorptions and photoionization. This fact is implemented in imaging, diagnostics, radiation therapy where high energy x-ray ineract with the radio sensitizing agents, such as, cis-platins, bromodeoxyuridyne (BUdR), gold nanoparticles etc while remain transparent to ligher biogenic elements. Inner shell interaction leads to ejection of Auger electrons that can kill the surrounding malignant cells in the tumor. The characteristic features of interaction of these compounds resemble mainly to those of the heavy element. Our study on the photo-absorption shows that compounds of high-Z elements, such as Pt, Au, embedded in tumors could provide the most efficient therapy and diagnostics (theranostics) when X-rays are targeted at their characteristic resonant energies where probability of electron ejection is enhanced by a large factor. We determine the resonant energies from the atomic properties of the high-Z element and show that they can initiate cascade of multiple ejections. Harmful damages from broadband radiation from conventional X-ray sources at medical facilities can be reduced considerably by using a monochromatic X-ray source at resonant energy. In this respect we will show that low energy x-rays of about a few hundred keV are more effective in treatment than those MeV range conventional liner accelators (LINAC).

Acknowledgement: Partially supported by DOE, NSF; Computational work was carried out at the Ohio Supercomputer Center