# AbstractID: 13990 Title: MicroCT-based methods of assessing imaging dose to active marrow and endosteum in CT, fluoroscopy, and nuclear medicine

**Purpose:** To present newly developed microCT-based methods for assessing radiation dose to radiosensitive tissues of the skeleton within computational patient phantoms for CT, fluoroscopy, and nuclear medicine imaging.

**Methods and Materials:** In this study, 13 skeletal sites were harvested from a 40-year male and a 45-year female cadaver from which 32 samples of trabecular spongiosa were cored from each and imaged under microCT. These images were thresholded and coupled to voxelized models of skeletal sites taken from the UF adult hybrid phantoms. EGSnrc-based *Paired Image Radiation Transport* was then performed for a series of monogenetic electrons localized in various spongiosa and cortical source tissues. The resultant electron absorbed fractions were used to assess (1) radionuclide S values for nuclear medicine dosimetry, and (2) bone-specific fluence-to-dose response functions for CT and fluoroscopic x-ray dosimetry.

**Results:** Radionuclide S values presented in this study uniquely account for the trabecular microstructure of adult bone, account for the finite size and shape of trabecular spongiosa, and allow for electron cross-fire from particle emissions within the cortical regions of mineral bone. For assessment of bone marrow and endosteum dose during CT imaging and fluoroscopic procedures, a detailed library of photon fluence-to-dose response functions is presented for assessing both regional and skeletal average dose to active marrow and endosteum.

**Conclusions:** Calculations of secondary electron transport in the microstructure of trabecular spongiosa of the adult skeleton reveal an enhancement of dose due to secondary electron disequilibrium for x-rays entering the skeleton at energies below 200 keV. Percent excess dose to active marrow over that predicted under the kerma approximation range from 1-5% in bones such as the pelvis to a high of 25% in the cranium. Percent excess dose to the skeletal endosteum can approach 100% in some bone sites over that predicted by the kerma approximation.