AbstractID: 2573 Title: Breast Cancer Extent Determination by Imaging and Tumor Sections

Although disease is frequently detected through imaging, it is the histological evaluation that provides the definitive diagnosis. Histological information also allows characterization of the disease and this information may influence therapeutic decisions. Frequently the extent of disease is underestimated on imaging and the histological examination provides information regarding multifocal disease as well as the size of the surgical disease-free margins surrounding the lesion. The probability of disease-free survival is related to margin size. Current histological methods used in the management of breast cancer suffer from three major limitations. These are: 1) the loss of information on the *in-vivo* conformation of tissue upon its removal from the breast, 2) difficulty in relating two-dimensional information seen on the small slides to the distribution of disease within a volume of tissue and 3) the undersampling of the tissue evaluated in the exam. We have begun a program to address these limitations through an approach that involves stabilization of the resected tissue in a gel, production of whole mount tissue sections, digital microscopy and efficient, high resolution 2-dimensional and 3-dimensional computer display of the images. To accomplish these goals it was necessary to develop new techniques for tissue processing and for image acquisition. This included the identification of a gel that would provide the required mechanical properties for maintaining tissue conformation while being compatible with the chemicals used for processing. Special tissue slicing methods were also implemented to allow reliable production of large tissue sections, a particular challenge for breast tissue. A modified regimen of processing yielded artifact-free serial sections. A modular multi-port microscope was modified to accommodate the large (12.5 cm x 17.5 cm) glass slides and provide computer-controlled indexing of the slide across the microscope's field of view to acquire the image digitally as a large set of sub-images or "tiles". Software was developed for automated focussing and registration of the mosaic of thousands of tiles to build the complete image. A database was used to keep track of the tiles and their registration. Images were displayed on a 9.2 Mpixel color monitor and a hierarchical display system facilitated the compromises associated with viewing the enormous data set (> 4 Gbytes per section) at different spatial resolutions and field sizes. The system is currently being used to address a number of questions related to breast cancer therapy planning as well as being applied to other tissue types.