CIMIT MEETING SUMMARY 11/18/03

The meeting, cosponsored by the MIT Spectroscopy Laboratory, the MGH Wellman Laboratories, the Harvard-MIT Division of Health Sciences and Technology and CIMIT, was devoted to the topic of "Molecular Markers and Cancer Progression". David Benaron, MD, Spectros Corp., spoke on "State of the Art in Optical Imaging Technology" and discussed three major areas for optical imaging: 1) Oncology and trace diseases, 2) Site-specific delivery of treatments and 3) Drug discovery. In oncology, optical techniques have application to disease staging, measuring the response to treatment and guiding surgical resection margins. In delivery of treatment, optics may be useful for both for localizing disease and monitoring treatment. In drug discovery, the applications include in vivo assessment of drug efficacy and rapid screening. Among the advantages of optical methods are the ability to detect single molecules and single cells, as well as real-time operation. A number of commercial optical systems now exist, including a time-domain breast imaging system using active contrast agents and a near-surface imaging systems for ischemia, which may be useful for tumor detection. Contrast agents may be genetically expressed or delivered to the patient. Among the interesting new contrast agents are folate receptor agents, which have shown tumor to background signal ratios as high as 400:1. Another agent family, based on 2-deoxyglucose, has accumulation proportional to glucose use and may serve as a general tumor imaging agent.

Lee Josephson, PhD, CMIR, MGH, spoke on "Optical Imaging of Apoptosis". Apoptosis is an early marker of response to cancer treatments such as chemo or radiotherapy. Apoptosis detection offers a means of predicting the effectiveness of cancer treatments before volumetric or metabolic changes are detectable. Apoptosis is marked by DNA fragmentation and the flipping of phosphatidyl serine (PS) from the inside to the outside of the cell membrane. This externalized PS can serve to bind Annexin V, to which CY5.5, a near-infrared fluorescent (NIRF) dye, is bound. A NIRF imaging system is being used to detect the surface fluorescence. The approach is being applied to the imaging of a chemotherapy-resistant Lewis lung carcinoma and its response to treatment.

John V. Frangioni, MD, BIDMC, spoke on "Optical Imaging in the Operating Room". A portable NIRF imaging system has been constructed and is being used for cancer detection; the group is also studying new contrast agents. These include the organic heptamethines, which emit in the 790-830 nm range and human serum albumin, which emits in a similar region. They are also studying quantum dots of materials such as CdS and CdSe. These dots have a number of interesting properties, including high quantum efficiency and the ability to tune the emission wavelength from the UV to the IR by varying the size of the dots. However the possible toxicity of the materials used remains to be resolved. A possible application under investigation is the location of sentinel lymph nodes, which requires the development of a dot which will stop at the node. Another application under consideration is monitoring cardioplegia during cardiac bypass.